

# ELECTRONICS

AUSTRALIA

VIDEO, HIFI & COMPUTERS

JUNE, 1981 AUST \$1.80\*

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*where do you  
stand?*



**Build:**

**3-way 100-litre  
Loudspeaker System  
Breakerless Ignition**



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Too often it's the forgotten component even in expensive component stereo systems. That's sad.

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Sony would like to recommend a sure thing. The Sony XL-55 Pro moving coil cartridge.

It's a highly original cartridge proved by exacting studio tests and critical home listening trials.

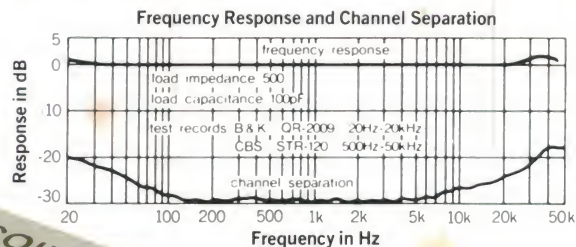
The moving coil cartridge, as compared with the moving magnet type of cartridge, uses a direct voltage generating system that obtains superior sound with extremely low distortion. Output voltage is very low and either a head amplifier or step-up transformer must be used. Sony's HA-50 Head Amplifier offers extremely low-noise amplification for virtually all kinds of MC (Moving Coil) cartridges.

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As only Sony can.



XL-55 Pro

## Specifications

Type:	Moving-coil
Output voltage:	0.2mV NAB (1kHz, 5cm sec, 45°)
Frequency response:	10-50,000Hz
Channel separation:	More than 30dB (1kHz)
Channel balance:	Less than 1dB (1kHz)
DC resistance:	40Ω
Impedance:	40Ω (1kHz)
Load impedance:	More than 40Ω
Compliance:	15 × 10 <sup>-6</sup> cm dyne
Tracking force:	1.5-2.5g (recommended value 2.0g)
Type of stylus:	Elliptical (0.3 × 0.8 mil) Nude diamond
Weight:	22g (including the shell)
Installation dimensions:	EIA

*Design and specifications subject to change without notice.*

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AP 3558



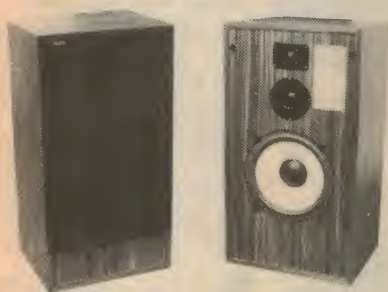
# ELECTRONICS

## AUSTRALIA

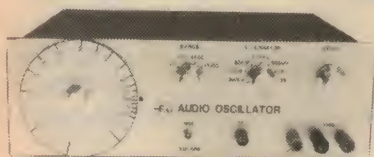
Volume 43, No. 6  
June, 1981

### AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

#### Build your own hifi loudspeakers



Called the Peerless PAS100, these new high-performance loudspeakers should satisfy the most discerning hifi enthusiast. We tell you how to build them (and save) on p60.



This low distortion audio oscillator features both sine and square wave outputs, and covers the frequency range 15Hz to 150kHz in four overlapping ranges. Details on p48.

COMING NEXT MONTH! - Find out what's coming by turning to p151.

#### On the cover

CAUGHT! - EA advertising manager Sel Sayers is apprehended by "the law" while taping his favourite movie on a video cassette recorder. Could this really happen? Find out where you stand with regard to copyright on p26. (Photo by staff photographer David Rattan.)

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# Editorial Viewpoint

## The copyright conundrum . . .

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When I set out to look at the subject of copyright for this month's "Forum", it was a fairly low key self-assignment which may well have climaxed in the traditional advice: "copying is okay provided it is done discreetly and for purely private purposes". However, in becoming involved, I also became actively aware of recent documents, and of articles and opinions in local and overseas publications. It became evident that the easy-going attitudes of the past are not going to suffice for much longer.

Behind the escalating tension is the fact that creative people — writers, artists, composers, musicians, actors, etc — must somehow be rewarded financially if they are to remain productive. The same is true of those who are prepared to invest money and effort in presenting creative talent to the public.

Traditionally, their rewards have been derived in part from the sale of books, magazines, records, films, etc, under the mantle of copyright law. However, during the past decade in particular, the means for copying text, audio and video have become so accessible and so effective that the entire creative system is threatened, along with the people who are part of it. Indeed they are on their way to becoming the victims of a vicious circle.

As copying erodes the sales of books, records and movies, production costs are concentrated in fewer originals, so that their unit cost rises. But, of course, that only provides an even greater incentive to save money by copying — albeit illegally. Somewhere down that road there has to be a crunch point!

As I worked my way through the "Forum" article it became increasingly apparent that technology had overtaken the processes of law and, thus, a clear understanding of social obligations and ethics. Yet who was I to reach such a conclusion? It was therefore reassuring — if rather cold comfort — to find the same views expressed in the Summary to the Report from the Committee on Audio and Video Reproduction and Copyright. (See quote in "Forum").

This was reinforced, some time later, by a feature article in the "Australian Financial Review", for April 28, 1981: "Technology Poses Big Problems in Copyright", by John Duthrie. The closing paragraph reads: "Whatever the solution, it is perhaps best summed up by one lawyer who said that, in terms of copyright protection, we have not even reached the tip of the iceberg!" And the summary, printed under the heading, was also noteworthy: "Lawyers can only ask questions about the subject; they are not in a position to provide the answers."

Think about it!

**Neville Williams**

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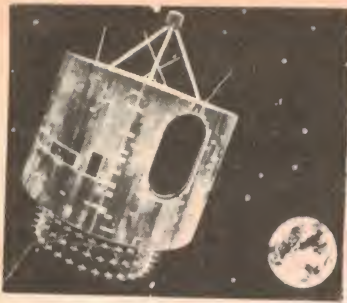
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# News Highlights

## IC manufacture: expert calls for increased Australian involvement

The chairman of the Australian Computer Society's National Hardware Technology and Hardware Industry Committee, Dr Bill Caelli, has come out in support of the development of an Australian capacity to produce specialised or "application oriented" integrated circuits.

If it is decided that Australia wishes to enter the microelectronics component industry then a careful decision has to be made as to what components may be most usefully made. Dr Caelli advocates the manufacturing of a limited range of standard components to augment general purpose components obtained overseas.

"In many cases today," Dr. Caelli has said, "lead times between order placement and delivery affecting Australian manufacturers may not be in the more sophisticated microprocessor and memory chips but in the less obvious, though equally vital, high speed or bipolar support chips".

These support circuits could be produced at a moderate-cost LSI (Large Scale Integration) facility which could be

created by drawing together existing Australian activities in the field, rather than investing in a more costly VLSI (Very Large Scale) facility.

Australia need not enter the race to export the components. By using standard imported components and Australian-made specialised parts, new and profitable products could be created for local consumption and export.

Dr Caelli has also issued a warning against the concept of Australian companies being involved in the information technology industry at the software level alone. He made the point that this type of activity was the most vulnerable to technological change. Increasingly applications software is being incorporated into the products themselves by overseas manufacturers, who are providing systems "ready to go" and tailored for a particular application.

The rapid growth of imports of high-technology equipment provides an indication of the marketing and balance of trade problems involved if Australia does not take a more self-sufficient role in manufacturing, Dr Caelli concluded.

## CB sets — half are illegal

The Federal Auditor-General's report tabled recently in Parliament estimates that about half the CB sets now in use in Australia are unlicensed! The estimate is based on a comparison between the number of CB sets being imported and the number of licences held.

Chances of illegal operators being caught by the Department of Communications are fairly remote, according to the report. Some states have only one officer to track down offenders, and it is said that some of the Department's detection equipment is "outmoded, inefficient and inadequate".

Changes to the licencing laws introduced in 1979 and higher fees are blamed for large scale avoidance of the licencing requirements.

## Telidon in Los Angeles

Informart of Canada recently announced that the Times Mirror Company has selected Telidon, the Canadian videotext system, for major field trials in the Los Angeles area. Telidon Videotext Systems Inc, a company established by Informart to sell the Telidon system to the US market, will supply the system under a contract worth over \$1 million.

The field trial is scheduled to start later this year and will include 200 terminals to be installed in homes in the Los Angeles area.

A unique aspect of the Times Mirror system is that it will operate simultaneously over both telephone and two-way cable networks. The trial system will offer data retrieval and interactive computer services using a DEC VAX 11/780 host computer.

## Hot competition for microcomputer market

A recent report from International Resource Development Inc predicts "cut-throat" competition for the provision of micro- and minicomputers sold on an OEM (Original Equipment Manufacturer) basis. No new suppliers are expected to enter the field, and several existing minicomputer suppliers may be pushed out of the market as semiconductor manufacturers diversify.

Shipments of single board computers exceeded \$300 million in 1980, the report states.

## Propeller-driven airliners on way back?

Research in the United States is demonstrating that a propeller-driven aeroplane with almost the same speed as a jet airliner but with much lower costs and noise levels may be feasible. A practical design is expected to be flight-tested soon to demonstrate the concept.

With the growing cost of fuel, propeller driven aircraft are becoming increasingly attractive to the airlines, particularly for short-haul "commuter" flights. Aircraft and engine designers are devoting much attention to attempts to improve the performance of this type of aircraft and the turbine engines that drive them. Now their interest is also turning to the propellers themselves.

In both the UK and the USA "conventional" propellers have been immensely improved by recent work. The typical four-bladed unit with long, slender blades is now being built extensively of fibre-glass reinforced plastic, over solid

aluminium spars. These techniques result in a propeller which weighs less and creates less noise.

But this is not the end of the story. Hamilton Standard of the USA, in conjunction with NASA, has produced a radical new propeller design which looks more like the screw of a ship than the familiar aircraft prop. The "prop-fan" has up to eight, short, wide and extremely thin blades which are curved and set close together in an over-lapping pattern. It is about half the diameter of conventional propeller (about two metres instead of four) and weighs about half as much.

The engineers responsible for the project are enthusiastic. They claim that the "prop-fan" will be able to drive turbine-engined aircraft at speeds of up to 650kph, while producing much lower noise levels than a jet engine and consuming between 20 and 40% less fuel.





## Handyman's shocking telephone connection

The April issue of *Telecom*, the journal of Telecom Australia, discloses some "shocking" facts. The "hotline" telephone shown in the photograph (left) was found in a home in Adelaide when a technician called on a new customer who had taken over a previously installed service.

It seems that the previous customer converted his telephone service to a portable system. He wired in six 240V AC power sockets in various parts of the house and then attached a three-pin 240V plug to the telephone.

The likely result of accidentally plugging the phone into a real mains socket can be imagined!

The technician immediately restored the telephone to a safe service.

## Pay TV feasible, but FACTS has misgivings about cable prospects

The Australian Broadcasting Tribunal's enquiry into cable television is expected to begin in mid-July, but the issues involved have already been clearly defined with the recent publication of 170 submissions to the Tribunal. Commercial television stations have misgivings about the introduction of cable TV, and the Australian Broadcasting Commission wants a review of the whole broadcasting field before any decision is made.

The Federation of Australian Commercial Television Stations said that the factors which might induce people to invest in cable television were poor reception of existing broadcasts, programs which are unavailable elsewhere, of availability of information services such as Teletext, and a pay TV facility.

Only pay television, which enabled people to subscribe to special movies,

was a valid consideration in Australia, the Federation said.

The ABC wants the tribunal to take into account the entire broadcasting system, including developments such as home video recording, which might affect the economic prospects of a cable television service.

The Federation of Australian Radio Broadcasters believes that the present broadcasting system makes a wide variety of quality programs available at little cost, and should be protected.

In contrast, Telecom Australia said that there were "no significant reasons" to delay the introduction of cable services. Australia Film Management Services Pty Ltd, a company set up to produce and promote Australian films, also supported the early introduction of cable television.

## "Anti-sound" system reduces turbine noise

A British research company, Top-express, has developed an "anti-sound" system which can reduce the rumble of a big stationary gas turbine installation to a whisper. The company has already built the first installation on top of the outlet stack of the British Gas Corporation pump at Duxford, which was said to previously produce objectionable noise levels at distances up to 2km.

Although the technique is at present limited to static sources of sound with frequencies between 20 and 50Hz, research is under way to extend it to silencing machines in factories. There are also prospects for reducing engine noise inside cars and aircraft.

The idea of cancelling one sound with another is not new. Sound consists of alternate zones of compression and rarefaction in the air, and it has been known since sound was first studied that it should be possible to make another sound so that the rarefactions of the first are cancelled by the compressions of the second, and vice versa. This effect can be easily demonstrated when the sound is of a single frequency.

The problem is more difficult if a band of frequencies is being radiated — nearly always the case in real situations. Then the sound has to be carefully "tailored" to cancel the unwanted noise. This is where the British research team has concentrated its efforts.

The features of the new "active silencer" are four microphones which pick up the noise, computing equipment for processing the sound signal, and audio power units consisting of 12 amplifiers capable of a peak level of 11kW! The amplifiers feed 72 loudspeakers spaced around the exhaust stack of the engine to be silenced.

The system can be set up to produce

(Continued on p6)

## SID — the latest in speech recognition

According to a recent report in "New Scientist", the British National Physical Laboratory has formed a "technology transfer" club to exploit advanced techniques in the recognition of human voices by computers. Several British companies, including Ferranti and Plessey, have already joined the group.

After about ten years of work, the NPL voice recognition project has developed microelectronic devices which can be incorporated in commercial products. The "Speech Input Device" (SID) is said to be more powerful and flexible than other techniques currently used, being able to recognise key words in the middle of a continuous flow of natural speech. Previous voice recognition devices have depended on understanding words and phrases

spoken in isolation. The device can also recognise voices from different speakers whereas present equipment is limited to recognition of the voice of the person who programmed it.

Sid works by transforming a person's voice into a code that can be processed by computer analysis. The analysis breaks down speech into about 16 "features" — similar to basic speech sounds (phonemes) identified by linguists. Typical features are sounds like "eh" and "s". Further analysis of the pattern of these features can identify particular words.

The voice recognition equipment can be used with a small computer, and is currently able to recognise up to 64 words. As the technique is developed, SID's vocabulary will increase.



## NEWS HIGHLIGHTS

### New van is powered by two engines



In Italy the Fiat Research Centre is investigating a dual power system for buses which could provide considerable savings in fuel consumption and improved performance.

The dual power system consists of a diesel engine coupled to a direct current generator which provides power to the electric motor driving the wheels. When more power is required, as when climbing hills or when the bus is fully loaded, a bank of accumulators is switched in, avoiding the need for driving the diesel engine any harder under these conditions.

When braking, the electric motor produces a current which can be used to charge the accumulators, providing further increases in the efficiency of the system.

A second dual power system being investigated by Fiat involves the use of a flywheel. A diesel engine drives a generator producing power for the electric motor, and also drives a flywheel which can be coupled to the generator to meet heavy power demands. Energy which accumulates during braking can also be stored in the flywheel and used to drive the generator.

### Canberra to get \$100 million wafer plant

A \$100 million silicon wafer plant seems certain to be established in Canberra by the National Semiconductor Corporation following an announcement recently of at least \$19 million worth of Federal Government assistance for the project.

The Minister for the Capital Territory, Mr Hodgman, said that the Government had agreed to provide land and buildings worth \$19 million for the plant in return for a number of concessions from the company.

Natsemi would in return, he said, commit itself to the transfer of existing and future technology, "most favoured customer" access to products, assistance with product development and the training of Australians.

At this stage the Government has invited Natsemi to examine the feasibility of establishing the plant in the ACT. But the corporation's managing director for Australia, Mr Jack Rutherford, said that he was confident that the project would go ahead.

### Italy goes for Prestel

Italy has become the seventh country to buy the technology of British Telecom's Prestel system. SIP, the Italian National telephone organisation, is acquiring Prestel software in order to carry out market research on public viewdata systems. They will obtain the computer from the British company GEC.

West Germany, the Netherlands, Switzerland, Austria and Hong Kong currently have Prestel systems operating, and private systems are being used in Belgium. The equipment is also undergoing trials in Norway, Sweden, Spain, Finland and Australia.

### Pressurised water reactor for Britain

Britain's Central Electricity Generating Board recently made formal application to the government to build the country's first pressurised water reactor (PWR) nuclear power station. The Board has said that it plans to build a PWR station of about 1200 megawatts next to the existing Magnox gas-cooled reactor at Sizewell in eastern England. The new station will be known as Sizewell B.

In a move apparently aimed at the export market, the government has already said that it wishes Britain to have an alternative technology to its gas-cooled reactors. The UK intends to develop a nuclear construction industry which can offer the latest technology in both gas and water cooled reactors.

The PWR is now the predominant reactor system throughout the world with more than 90 such stations operating in 16 countries. More than 130 pressurised water reactors are under construction throughout the world.

### China turns to tidal power

The Peoples Republic of China looks set to become the third nation in the world to adopt tidal power on a large scale. A 500kW station working on both ebb and flow tides in Yueqing Bay in the east China Sea will be enlarged to twice its current size by the end of this year, and will ultimately have six 500kW turbines.

The existing station is already slightly larger than a unit which has operated near Murmansk in the Soviet Arctic for the past 12 years. However it is small compared to the Rance station in Brittany, France, which has a capacity of 240MW.

The Yueqing Bay station cost over \$1 million to build. It consists of an earth and stone dam 670m long and 15.5m high spanning a river mouth to create a reservoir. The turbine embedded in the dam has a rotor 2.5m in diameter and weighs 86.7 tonnes.

### Anti-sound system ctd ...

exactly the opposite of the original sound field at the points surrounding the installation site. Sensing circuitry detects any changes in the noise and is fast enough to respond immediately for sounds below about 50Hz. As frequencies get higher the time available for response is reduced, and correction is more difficult.

Fortunately, in most applications it is cheaper to muffle the sound above a few hundred Hertz with conventional baffles etc. For this reason, future noise reduction systems are likely to consist of a combination of active and conventional mufflers.



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# The Official Line

— from the Department of Communications

## The allocation of television frequencies

One of the responsibilities of the Department of Communications is to allocate frequencies for services in MF and FM radio and the television broadcasting bands. At present frequencies are allocated in the MF (medium frequency), VHF (very high frequency) and UHF (ultra high frequency) spectrum.

A list of Australian VHF television channels is shown in Table 1. The channels are not regularly spaced but can be divided into low band channels (0-5) and high-band channels (5A-11). The high band channels are less prone to impulse interference.

Table 1: VHF Channels

Channel	Vision Carrier Frequency	Frequency Limits MHz
0	46.25	45-52
1	57.25	56-63
2	64.25	63-70
3	86.25	85-92
4	95.25	94-101
5	102.25	101-108
5A	138.25	137-144
6	175.25	174-181
7	182.25	181-188
8	189.25	188-195
9	196.25	195-202
10	209.25	208-215
11	216.25	215-222

The VHF spectrum is presently quite congested — particularly in the eastern states of Australia and, to ease this, UHF band IV (520-585MHz) and UHF band V (614-820MHz) are now being used for television services. Future television broadcasting services will rely heavily on increased allocations of UHF channels, rather than VHF.

To cater for the development of FM broadcasting in Australia in the 88-108MHz band, it would be necessary to re-allocate some VHF television channels.

Before allocating a vacant channel to any given area, several factors need to be considered. These generally relate to the presence of existing services and limitations in the ability of television receivers to reject unwanted signals. Factors to be considered include:

- Co-channel interference from neighbouring services;
- Adjacent channel interference from existing services in the same area;

• Interference caused by signals radiated from the local oscillator of television receivers tuned to existing services in the same area;

• Possible intermodulation effects from existing services;

• Anomalous propagation of signals from services using the same channel in distant areas.

Generally, for high power stations (VHF 100kW, UHF 300kW) the same channel cannot be used again within some 300-400 kilometres depending upon terrain. Before allocating the same channel again, interference levels which would result at the boundaries of the service areas of co-channel stations are estimated, using various propagation prediction methods. Where the results of prediction methods are uncertain it is necessary to perform propagation tests and/or field measurements.

Interference protection between transmitters on the same channel can be improved by using opposite polarisation (cross polarising) on the two sharing services. For a typical domestic receiver installation the use of cross polarisation improves interference protection by about 10dB.

Another technique for reducing co-channel interference is to offset the frequencies of television transmitters sharing the same channel. When two stations operating on nominally the same frequency are received together, a low frequency beat pattern will be evident on the screen of the television receiver. By offsetting the transmitter carriers, say by 10kHz, the beat pattern produced is of higher frequency and is less discernible to the viewer.

It is necessary that the possibility of anomalous, long distance propagation effects are also taken into account when considering the possibilities of co-channel interference. Co-channel allocations are avoided over areas which are prone to extended propagation via the troposphere. Because of the large number of areas affected by extended tropospheric propagation, particularly in coastal regions, it is difficult to avoid occasional instances of such interference.

The lower frequency channels, particularly channel 0, are subject to mutual interference when long distance propagation occasionally occurs via the E layer (sporadic E propagation). The effects of sporadic E interference are minimised by offsetting the frequencies of likely interfering stations and employing directional antenna transmitting patterns. As well as this, channel 0 and channel 1 allocations in northern Australia may be subject to transequatorial propagation interference from low-band Chinese and Korean television stations.

Examination of the Australian VHF channel system shows that some channels are immediately adjacent to each other. As the selectivity of domestic television receivers is generally less than ideal, adjacent channel frequencies cause interference if they exist in the one area. To avoid the possibility of this form of interference, adjacent channels are not allocated in the same service area. At UHF frequencies, where television tuner response is comparatively broad, services operating in the same area have to be separated by two channels.

Another complication can be that certain combinations of channels result in the possibility of interference caused by radiation from the local oscillator of television receivers tuned to existing services in the same area. For example, the local oscillator of a television receiver tuned to channel 7 will fall within channel 11, and at close range may interfere with the reception of a wanted channel 11 on another set. Combinations of channels which will result in local oscillator radiation problems are avoided.

Some combinations of channels are unusable because of the design of television receivers. One example of this is where the frequency difference between two channels falls within the intermediate frequency bandwidth of the receiver (30-38MHz). Thus channel 5A and channel 6 cannot be used in the same area as their signals would mix in the front-end of the television receiver and produce an unwanted intermodulation product at the receiver's intermediate frequency.

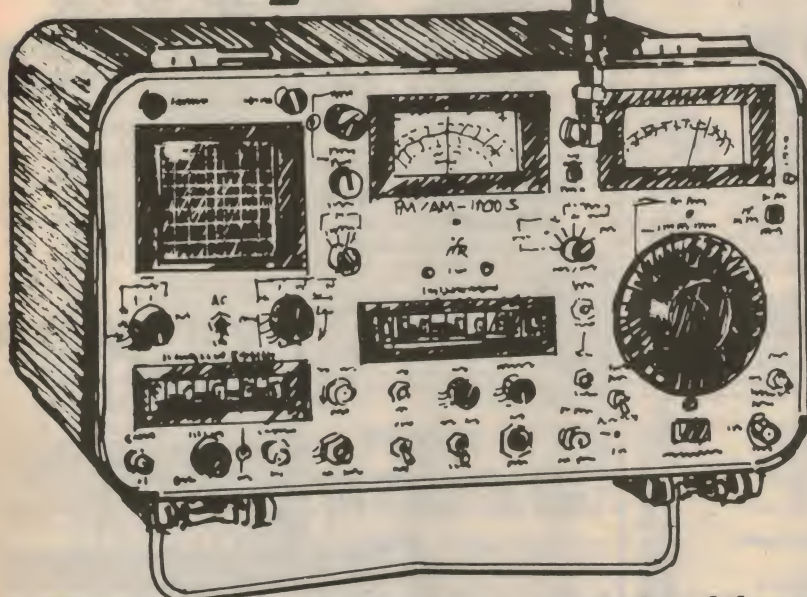
Apart from the technical aspects of allocating television frequencies there are also planning issues to be considered. Although development of the VHF spectrum is well advanced, attempts are now being made to rationalize channel groupings in country and metropolitan areas. The 2, 7, 9, 10 grouping for capital city VHF channel allocations is one example of this. As well as this, the channel allocations for VHF bands are being made in regular groups for metropolitan and country areas because this assists in more economic use of the available frequency spectrum.

R. B. Lansdown, Secretary,  
Department of Communications.



This Service Monitor sets the standards for what a Communications Test Set Needs to be!

# FM/AM-1000S with built-in Spectrum Analyzer



**We gave you the features you needed and the performance you expected to get the job done . . . on the bench and on the go!**

The FM/AM-1000S is a compact, light weight, completely portable test set which is easily and efficiently used with no sacrifice in versatility. Its ruggedly constructed circuits are housed in a deep-drawn, heavy gauge metal case, allowing it to withstand the rigors of portable operation as well as being a highly functional bench instrument.

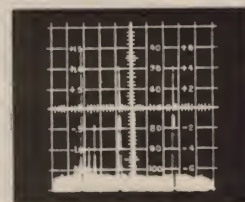
As a generator, the FM/AM-1000S features continuous frequency coverage from 100 Hz to 1 GHz, AM or FM modulation, internal variable audio tone generator, 1000 Hz fixed tone generator, and 0 dBm RF output level into 50 ohms.

Automatic switching to monitor mode occurs at 100 MW, allowing measurement of transmitter frequency, FM deviation or % AM modulation, and RF power throughout the operating range of the test set.

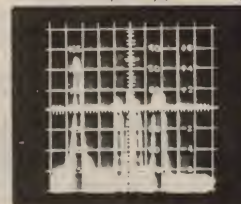
A sensitive receiver allows measuring the characteristics of radiated signals, including SSB and DSB. The Beat Frequency Oscillator features variable injection level and is phase-locked to the master oscillator for precise suppressed carrier frequency measurement. The 15 kHz Narrow IF selectivity allows monitoring a desired signal within 25 kHz of adjacent channel interference without difficulty.

The Oscilloscope/Spectrum Analyzer operates simultaneously with all other indicators to provide detailed analysis of monitored signals. The 70 dB dynamic range of the analyzer is equal to that of many individual analyzers.

**Features . . . Performance . . . Portability.** The FM/AM-1000S. Communications Service Monitor has them all – plus it's priced below comparable, competitive test equipment.



**WIDE DISPERSION:**  
Analyzer sweeps  $\pm 5$  MHz from selected frequency (10 MHz span)



**NARROW DISPERSION:**  
Analyzer sweeps  $\pm 0.5$  MHz from selected frequency (1 MHz span)



**OSCILLOSCOPE:**  
Oscilloscope features DC to 1 MHz frequency response

**ifr** INC. *the best is cost effective*

## PROFESSIONAL DIVISION:

Melbourne: (03) 699 6700  
Sydney: (02) 436 2766  
W.A. (09) 325 5722  
Queensland: (07) 352 5222  
New Zealand: 69 7625



**SYDNEY: 339 PACIFIC HWY, CROWS NEST N.S.W. 2065**  
**TELEPHONE: (02) 436 2766**

**MELBOURNE: 68 EASTERN RD., STH. MELBOURNE, VIC. 3205**  
**TELEPHONE: (03) 699 6700**



## PARTS FOR NEW KITS

See also our advert elsewhere in this magazine with new kits since our last catalog.

**BENCHMATE** (See EA June)  
Complete kit, inc. inst. K-3478 \$45.00  
\*Ext. speaker required: use our A-2451 @ \$9.50  
PCB only H-8400 \$3.95

**HOT CANARY** (See EA May)  
Complete kit, inc. inst. K-3245 \$14.95  
PCB only H-8396 \$2.25

**SPEED SENTRY** (See EA May)  
Complete kit, inc. inst. K-3245 \$11.75  
PCB only H-8399 \$1.95

**INFRA RED REMOTE CONTROL** (See EA May)  
Full kit, inc. inst. K-3380 \$63.95  
PCB only H-8397 \$6.95

**dB METER** (See EA May)  
Complete kit, inc. inst. K-3476 \$34.50  
PCB only H-8398 \$2.35

**UHF TV DOWNCONVERTER** (See ETI May)  
Full kit, inc. inst. K-3235 \$32.50  
PCB only H-8637 \$2.95

**UNIVERSAL RELAY DRIVER** (See ETI May)  
PCB only H-8638 \$2.25  
(All parts for this kit are normal stock lines)

**SYSTEM 80/TRS 80 SERIAL INTERFACE** (See EA April)  
Full kit, inc. inst. K-3608 \$57.50  
PCB only H-8394 \$7.95

**INFRA RED BEAM RELAY** (See EA April)  
Full kit, inc. inst. K-3375 \$37.50  
PCB only H-8395 \$3.95

**CORE BALANCE RELAY** (See ETI April)  
Full kit, inc. inst. K-3315 \$49.50  
PCB only H-8635 \$4.50

**NEGATIVE ION GENERATOR** (See ETI April)  
Complete kit, inc. inst. K-3335 \$41.95  
PCB only H-8634 \$3.95

(Above prices & dates are from magazine estimates only. We cannot guarantee that the articles will appear when specified).

## BUILD A KIT:

It's simple and it's FUN. Quality Dick Smith kits, complete with instructions to make electronics really enjoyable!

### TRANSISTORS TESTER



\$1975

This one tests bipolar transistors, diodes, FET's and even SCR's & PUT's. It's a low cost and practical instrument simple enough for a beginner to build. Ideal also for the serviceman. A valuable piece of test equipment you can't afford to miss! Cat. K-3052

### TV CRO ADAPTOR

PUT YOUR OLD B&W TV TO WORK!

\$2995



If you're tired of many people, you never could bring yourself to throwing out the old b&w tv. Lucky you! EA have come up with a kit which enables you to use that old tv set as an audio CRO! You've always wanted a CRO, but could never justify buying one, right? Now you can have your own CRO for next to nothing, and the screen's big, too! Cat. K-3080

## UPDATE YOUR AUDIO SYSTEM!

AND SAVE WHILE THEY'RE REDUCED!!

### Playmaster AM/FM Tuner/Clock

Superb quality AM and FM stereo tuner which also doubles as a highly accurate digital clock. Easy to build: all the hard work is done for you as the tuner section is pre-built and tested. Superb! Cat. K-3484

\$15990  
\$12950

### Playmaster Graphic Equaliser

Your listening room probably does horrible things to your sound! You can correct these errors with a graphic equaliser - and make your music exactly as the original! Step-by-step instructions included. Cat. K-3500

\$9990  
\$7500

### Playmaster Graphic Analyser

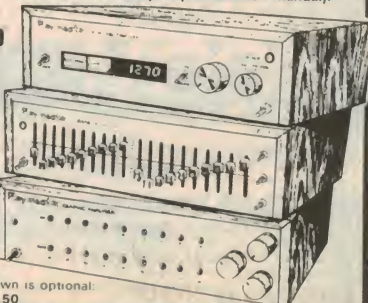
Want to REALLY get the best from your system? The Playmaster Graphic Analyser tells you where the problem areas are: you can set your graphic equaliser up perfectly. And it also doubles as a brilliant LED audio level meter the rest of the time! Cat. K-3510

\$9990  
\$7500

Timber sleeve shown is optional. Cat. H-3113 @ \$8.50

## QUALITY PLAYMASTER AUDIO KITS

Want real value and real quality in hi fi? You can't go past the famous Playmaster kit range from Dick Smith Electronics. Designed by Electronics Australia magazine, each of these kits will add a new dimension to your system. Easy to build (each kit comes with our exclusive step-by-step instruction manual).



## DON'T MISS OUR GIANT DINKI DI MAILER FREE IN THIS ISSUE!

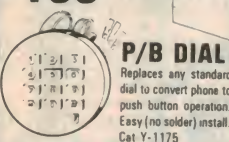
(Or available at your nearest Dick Smith store)

### SPECIAL PHONES FOR SPECIAL PEOPLE!

#### 'CORDLESS' PHONE

Receive or make calls up to 100m away from your phone. Includes 'phone' and base unit/charger. Cat. Y-1178

\$199



\$4990 \$3950

#### CUTIE PHONE

The name says it all! It's cute and it folds flat when not in use. Push button dialling with last no. recall, simple to install. Cat. Y-1179

PLEASE NOTE: These 'phone' devices are not Telecom approved and should not be used on Telecom lines.

We're often asked which of the electronics and computer magazines we have available. All of the following are normally stock; however some (especially overseas) magazines are in very limited quantities. Check with your nearest store.

Cat. No.	Title	Price
B-5010	Electronics Australia	\$1.80
B-5015	Electronics Today Int.	\$1.75
B-5030	Everyday Electronics (UK)	\$1.00
B-5032	Practical Electronics (UK)	\$1.10
B-5040	Wireless World (UK)	\$2.40
B-5044	Amateur Radio Action (Aust)	\$1.30
B-5050	QST (USA)	\$2.90
B-5059	Australian Personal Computer	\$1.95
B-5061	Byte (USA)	\$2.95
B-5062	Micro 80 (Aust)	\$2.50
B-5064	80 Microcomputing (USA)	\$2.50
B-5065	Kilobaud (USA)	\$2.95
B-5066	Creative Computing (USA)	\$2.95
B-5071	Popular Electronics (USA)	\$1.25
B-5074	Radio Electronics (USA)	\$1.75
B-5090	Elaktor (UK/Europe)	\$1.70

PLEASE NOTE: Above magazines are not available from our Mail Order Centre.

**WATCH THIS SPOT**  
To see what you missed out on!  
Did you miss out on our BELOW COST SPECIAL?  
**LAST MONTH:**  
200g roll solder  
for only \$2.40 (normally \$4.95)  
**SAVING YOU \$2.55**  
**NEXT MONTH:**  
?????

## HUGE SAVING ON 4116 RAMS!

Top quality, prime spec (yes, the fast 250nS type) at an incredible price reduction. Check this out:

**16k KIT (8 IC's)**  
(Were over \$200 18 months ago: Some people still charge that!)  
**NOW ONLY:**  
\$2995 Cat X-1188

**INDIVIDUAL IC'S:**  
Again, the prime spec variety: Cat. Z-9310  
**WERE \$995**  
**\$395**



Cat. B-2081 \$1795

### NOW IN STOCK!

The brand new 1981 edition of the World Radio TV Handbook: the international 'bible' of broadcasting. Get right up to date! Includes details of WARC '79. A must for SWL's.

### NEW! 6 CHANNEL MARINE 2-WAY

How's this one! Fully approved hand-held two way for boatsmen, fishermen, etc. Maximum legal power of 5 watts, capable of 6 channel operation (one channel comes already fitted with the emergency channel of 27.88MHz). External jacks allow you to connect to boat power, antenna, etc. for greater range. 3-way meter shows battery strength, transmit power and received signal strength. A must for anyone concerned with their own safety! Cat. D-1123

\$12000

### TIME IT! CLOCK IT!

This superb liquid crystal stopwatch/clock is just the go for today's modern sportsman: whether taking part, or watching from the sidelines! Huge, easy to read digits, giving time to 1/100th second, also does lap times, etc. And it's also a highly accurate clock! Incredible value. We've seen similar models for \$100 and more! Cat. Y-1041



\$3950

### VEHICLE NOISE?

Kill annoying whines, cracks & clicks with our range of automotive electrical noise suppressors. Easy to fit - and your ears will thank you!

#### SPARK PLUG SUPPRESSOR:

Fit into spark plug lead. Self-threaded for easy fitting.

Cat. A-7908 65c



#### COAX ALTERNATOR SUPPRESSOR

Gets rid of that whine. Heavy duty.

Cat. A-7928 \$4.95

#### INLINE DISTRIBUTOR SUPPRESSOR

Connects in distributor coil lead. Easy to mount.

Cat. A-7904 50c

#### GENERATOR NOISE SUPPRESSOR

Heavy duty. Easy mounting with only a screwdriver.

Cat. A-7902 65c

#### ALTERNATOR NOISE SUPPRESSOR

Has 3 leads. Greatly reduces alternator whine.

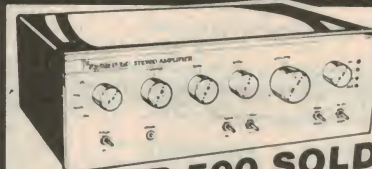
Cat. A-7924 \$2.50

#### DELUXE ALTERNATOR SUPPRESSOR

High density ferrite core. Excellent results.

Cat. A-7926 \$9.50

## NEW PLAYMASTER MOSFET AMP KIT



**OVER 500 SOLD IN THREE MONTHS!**

Electronics Australia's brilliant new design, featuring the very latest in solid state technology power mosfets. A stunning sound, with a huge 50 watts per channel output! This new Playmaster features loudness and muting controls, plus full range bass & treble controls. Input selection is shown by LEDs, and speakers can be switched from the front panel (two sets of speakers can be used).

Over 500 customers cannot be wrong the new Playmaster Mosfet Stereo Amplifier is a worthy update for any hi fi system - and because you build it yourself, you save a fortune over comparable commercial amplifiers!

Each kit includes comprehensive step-by-step instruction manual, complete with our exclusive 'Sorry, Dick - it doesn't work' coupon: if you run into trouble, we'll fix your problems for a small fee!

**EXCLUSIVE FEATURES ONLY IN THE DICK SMITH KIT!**



Cat. K-3515  
\$15900



## B-R-R-R-R!

Control your winter warmth!

A Kambrook Time Switch on your heaters, electric blankets, etc etc will make the cold much more bearable! Imagine getting into a bed already warmed for you: the Kambrook can turn your electric blanket on whenever you like. Or the bathroom can be heated for your morning shower BEFORE you get up! Controls up to 10A, 240V.  
(Use for swimming pool filters in summer, too!) Cat Y-1120



## MAINS WIRING?

These useful mains wiring aids from Dick Smith make the job that much easier...



**WALL MOUNTING BOX**  
Accepts standard switch plates, power outlets, TV outlets, etc. Proud of wall: enough room for wiring & outlet, etc, within box. Cat P-5531



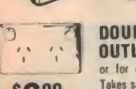
### WALLBOARD CLIP

Great for fibrous plaster, fibro, masonite, ply, etc: lugs clip over wall board, power outlet screws on so it is flush with wall. Ideal for new installations in old buildings. Cat P-5530



### Junction Box

For mains cable connections; complete with connectors. As used by electricians, etc. Cat P-5625



### DOUBLE POWER OUTLET

For new jobs or for converting singles. Takes same space as single. Cat P-5568

### POWER OUTLET SAFETY CHECKER

Check outlets easily and safely. 3 lights give instant good/bad reading. Cat P-5300

**\$1.25**

**45¢**

**\$1.70**

**\$4.95**

**LARGE CASE (Ideal for amps, etc)**  
Size 270 x 250 x 80mm. Cat H-3110

**SMALL CASE (Incredibly versatile)**  
Size 250 x 200 x 80mm Cat H-3160

**PANEL TO SUIT: Cat H-3111 @ \$4.90**

**Panel to suit: Cat H-3161 @ \$4.50**

## NO OZONE: JUST GOOD IONS!



Cat Y-9000

Medical authorities tell us how good negative ions are for us: the effect is just like being near a mountain waterfall. But beware: some generators produce dangerous ozone too! Not this one: checked by the University of New South Wales; it produces safe and beneficial negative ions ONLY! 240V operated, uses virtually no power!

**\$85.00!**

## NICAD PRICES TUMBLE!

Since we announced our large-size NiCad batteries we've been swamped. So we've made another huge purchase: only this time we bought bulk packs. There are two batteries packed on a card: because you buy in bulk too, you save!

'C' Cells Cat S-3302 Were \$4.25 each, **NOW \$7.50 pack 2!**  
'D' Cells Cat S-3304 Were \$4.50 each, **NOW \$7.95 pack 2!**  
'AA' (penlight) Cells Cat S-3300 (Still available singly): Reduced for June & July ONLY. Were \$2.05 ea, **NOW 1.95 ea.**

## CHARGING NICADS:

Use our M-9517 NiCad battery charger and your choice of our battery holders to suit the size & number of cells. See our 1981 catalog, page 97, for more details.

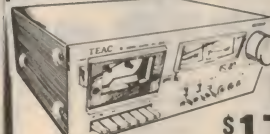
## NEW! 3.5 DIGIT LCD

A MUST FOR THE SERVICE TECH, SERIOUS HOBBYIST ETC!



**\$75**  
Cat Q-1450

Amazing value for such a versatile and accurate instrument. Features 20 ranges up to 600V DC, 1kV AC and 200mA DC, at an accuracy of 0.8% (Operates from a single 9 volt battery (supplied) and it measures only 90 x 170 x 25mm. An investment that will pay for itself over and over.



**NEW! \$179.00**

**TEAC QUALITY METAL DECK**  
We've been searching for a deck like this for some time - and here it is. A superbly made unit, featuring the latest in technology: metal capability (of course); Dolby noise reduction (of course); separate bias & equalisation switching, peak reading LEDs as well as large vu meters - the features go on and on. Call into a Dick Smith store and check this superb deck out - but soon. You might miss out! Cat A-3501

Noticed the price of Dick Smith cassette tape in the mailer? You should: it's half price! Yes, quality Dick Smith cassettes for half their normal price. See them in the mailer in this magazine!

## NEW PROGRAMS

For the System 80 Computer (will also run on TRS-80 lev II)

**Flight Simulator:**  
Accurate flight characteristics and fast animation really put you in the pilot's seat! For non-pilots, learn the basics of flight. For experienced pilots, explore an aircraft's capabilities without risking a plane! The makers say that no flight simulator under \$100,000 can match the realism! Cat X-3684 **\$34.90**

**MUSICAL COMPUTER:**  
Learn music - even without knowing a note. This program will teach you! It's an alternative to conventional music education, or it's a great assistance to it. Covers all the basics of music recognition. Cat X-3640 **\$39.95**

**AT LAST! 'SPACE INVADERS' GAME!**  
Here it is: a superb version of the most popular arcade game in the world. The major difference is that you don't have to keep pumping two bob bits down your computer's throat! All the fun - without the expense. And just look at the price of this program!! Cat X-3699 **\$9.95**

**AND MORE GAMES:**  
Enter a world where fantasy is at your fingertips! These games are not only fun, they're challenging and mentally stimulating. These are all from the 'EPYX' series by one of the world leaders in computer games. Automated Simulations of the USA (Cat X-3641) **\$39.95**  
**TEMPLE OF APOLLO** (Cat X-3642) **\$39.95**  
**HELLFIRE WARRIOR** (Cat X-3643) **\$39.95**  
**STAR WARRIOR** (Cat X-3644) **\$39.95**

Ask at your nearest Dick Smith store for a full listing of currently available computer programs

## AND NOW OPEN IN NEWCASTLE

We've finally found a great store location in Newcastle: handy to everywhere, and with parking available! You'll find us in Tighes Hill, almost opposite Newcastle Tech. Why not call in and say hello!

**173 MAITLAND ROAD, TIGHES HILL**



## NEW SEMICONDUCTORS

We're always bringing our semiconductor range up to date... Here are the latest additions. These are NOT included in the 1981 Dick Smith catalog. If a device YOU want is not here, why not ask for it anyway? We may stock it already; and if we don't, we'll certainly consider stocking it if there is sufficient demand.

4046 Phase-locked-loop	Z-5646 \$1.95
74LS367 Hex bus driver	Z-5292 75¢
74LS174 6 bit D flip flop	Z-5290 \$1.00
74LS139 Multiplexer	Z-5285 90¢
74157 Multiplexer	Z-5267 85¢
2516/2716 16K EPROM	Z-5207 \$11.95
LM311 Voltage comparator	Z-6048 70¢
74LS373 Dual D flip flop	Z-5295 \$1.95
74LS165 Par. load 8 bit shift register	Z-5288 \$1.65
74LS86 Quad 2 input OR gate	Z-4986 45¢
74LS27 triple 3 input NOR gate	Z-4927 40¢
74LS05 Hex Inverter	Z-4905 35¢
74109 Dual J-K triggered flip-flop	Z-5252 50¢
LM339N Quad Comparator	Z-6039 70¢
81LS95/97 Tri State Octal Driver	Z-5300 \$1.80
CD4040 14 st. ripple carry bin. counter	Z-5640 \$1.70
CD4069 Inverter	Z-5669 45¢
CD4526 4 bit prog. down counter	Z-5744 \$1.65
74LS132 Quad 2 input Schmitt trigger	Z-5283 \$1.70

# DICK SMITH ELECTRONICS

- NSW**
- AUBURN: 145 Parramatta Rd. 648 0558.
  - BLAKEHURST: 613 Princes Hwy. 546 7744.
  - BROADWAY: 818 George Street. 211 3777.
  - BROOKVALE: 531 Pittwater Rd. 93 0441.
  - CHULLORA: 147 Hume Hwy. 642 8922.
  - GORE HILL: 162 Pacific Hwy. 439 5311.
  - PARRAMATTA: 30 Grose Street. 683 1133.
  - SYDNEY: 125 York Street. 290 3377.
  - WOLLONGONG: 263 Kiera Street. 28 3800.
  - TIGHES HILL: (Newcastle) 173 Maitland Rd
- ACT**
- Fyshwick: 96 Gladstone Street. 80 4944.
- QLD**
- BURANDA: 166 Logan Rd. 391 6233.
  - CHERMSIDE: 842 Gympie Rd. 59 6255.
  - ADELAIDE: 60 Wright Street. 212 1962.
  - MELBOURNE: 399 Lonsdale Street. 67 9834.
  - RICHMOND: 656 Bridge Rd. 428 1614.
  - SPRINGVALE: Dandenong & S'vale Rds. 547 0522.
  - PERTH: 414 William Street. 328 6944.
  - CANNINGTON: Wharf St & Albany Hwy. 451 8666.
- SA VIC**
- WA**
- PRICES CORRECT FOR MONTH OF PUBLICATION OR WHILE STOCKS LAST.**  
PO Box 321, North Ryde, N.S.W. 2113. Ph: (02) 888 3200.

### DICK SMITH MAIL ORDER CENTRE:

SERVICE CENTRE LANE COVE & WATERLOO RDS, NORTH RYDE NSW

2113. PHONE (02) 888 3200. 9AM TO 5PM. MONDAY TO FRIDAY ONLY

SHOP HOURS: 9AM - 5:30PM Mon - Fri, 9AM - NOON Sat. (Brisbane 1/2 hr earlier).  
Some stores open for late night shopping: please phone store before making special trip in!

### MAJOR DICK SMITH RE-SELLERS:

- ATHERTON, QLD:** Tableland Radio Service  
2 Jack Street. Phone 912 017
- BENDIGO, VIC:** Summer Electronics  
95 Mitchell Street. Phone 421 977
- BLACKHEATH, NSW:** Goodwin Electronics  
123 Station Street. Phone 878 379
- BROKEN HILL, NSW:** Crystal TV Rentals  
66 Crystal Street. Phone 6897
- CAIRNS, QLD:** Thompson Instrument Services  
79 81 McLeod Street. Phone 512 404
- COFFS HARBOUR, NSW:** Coffs Harbour Electronics  
3 Coffs Harbour Plaza, Park Ave. Phone 525 684
- DARWIN, NT:** Kent Electronics  
42 Stuart Highway. Phone 814 749
- DUBBO, NSW:** Seleksa Sound.  
31 Talbragar Street. 826 979
- EAST MAITLAND, NSW:** East Maitland Electronics.  
Cnr Lewis & High Streets. 337 327
- FAIRY MEADOW, NSW:** Trilogy Wholesale Elect.  
40 Princes Hwy. Phone 831 219
- GERALDTON, WA:** KB Electronics & Marine  
361 Main Terrace. Phone 212 176
- GOSFORD, NSW:** Tomorrow's Electronics & Hi Fi  
68 William Street. Phone 247 246
- HOBART, TAS:** Aero Electronics  
123a Bathurst Street. Phone 348 732
- KINGSTON, TAS:** Kingston Electronics & Records  
Channel Court. Phone 296 802
- LAUNCESTON, TAS:** Advanced Electronics  
5a The Quadrant. Phone 317 075
- LISMORE, NSW:** Decro Electric  
Magellan St & Brunner Hwy. Phone 214 137
- MACKAY, QLD:** Stevens Electronics  
42 Victoria Street. Phone 511 723
- MARYBOROUGH, QLD:** Keller Electronics  
218 Adelaide Street. Phone 214 559
- MORUYA, NSW:** Coastal Electronics  
43 Vulcan Street. Phone 742 545
- MT GAMBIER, SA:** Hutchesson's Communications  
5 Elizabeth Street. Phone 256 404
- MUSWELLBROOK, NSW:** Silicon Chip Electronics  
Suite 3. 98 Bridge Street. Phone 43 1098
- NAMBOUR, QLD:** Nambour Electronic Shop  
Shop 4. Lowan House. Ann St. Phone 611 604
- NEWCASTLE, NSW:** Elektron 2000  
181 Wharf Road. Phone 262 644
- ORANGE, NSW:** MSW Electronics  
48 McNamara Street. Phone 626 481
- ROCKHAMPTON, QLD:** Purely Electronics  
15 East Street. Phone 21 058
- SOUTHPORT, QLD:** Amateur's Paradise  
121 Newang Street. Phone 322 644
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# NEW DEVELOPMENTS IN

# JAMMING

*With us since radio's early days, jamming stands as the biggest obstacle in the way of fair use of the shortwave broadcast-bands. Here's a look at the current situation.*

by **STANLEY LEINWOLL**

What will probably turn out to be the most important shortwave broadcasting conference ever held has been scheduled by the Administrative Council of the International Telecommunication Union for January 1983. A second session is scheduled for October 1984.

The Conference has its work cut out for it, with a number of major obstacles to overcome before any serious effort at planning can succeed. One of the problems overhanging the Conference like a dark and ominous cloud is jamming. Indeed, many of the world's most competent shortwave broadcasting experts feel that rational planning of high frequency broadcasting is impossible as long as jamming continues.

To understand fully why jamming and technically feasible high frequency broadcast planning are judged by many observers to be incompatible, it is necessary to provide some information about jamming, and to describe attempts by jammed broadcasters to overcome it.

Jamming is the deliberate transmission of raucous, irritating noise and other interference on a frequency in order to hamper or utterly destroy the programs of another broadcaster operating on the same frequency.

Jamming doesn't only interfere with the target broadcast; it also degrades the transmissions of broadcasters operating on adjacent frequencies because of its broadband characteristics. Consequently, for each frequency jammed, three are adversely affected, as a rule: the one be-

ing jammed, plus the frequency on either side of that one.

During the height of the Cold War, virtually every major Western broadcaster transmitting to the Communist world was jammed. In recent years, however, there has been a decrease in jamming; but it is still a serious blight on the short-wave spectrum. At the present time the USSR and some of its satellite countries are responsible for most of the jamming being observed. Soviet jamming is currently being directed principally toward the broadcasts of Radio Free Europe, Radio Liberty, The Voice of Israel, and the People's Republic of China. In addition, the People's Republic of China jams some Soviet programs beamed to China.

To accomplish their task, the USSR and its satellites have developed a highly complicated and very sophisticated jamming network, consisting of several thousand jammers at hundreds of different locations throughout eastern Europe. It is estimated that it takes about five thousand technicians and administrators to operate the jamming system at a cost far exceeding that of the broadcasts being jammed. Furthermore, the original cost of setting up such a jamming system probably exceeded a quarter of a billion dollars.

There are two types of jammers: local, and sky-wave. Local jammers operate primarily in and around large population centres, usually those with a population of a quarter of a million or more persons. They are generally located so that they overlook the region to be jammed. Local

jamming, which is often incorrectly referred to as ground-wave jamming, consists principally of a direct wave and a reflected wave, as shown in Fig. 1. It is evident, from Fig. 1, that ground-wave jamming plays a relatively minor role in the effectiveness of that type of jammer.

The effective range of local jammers depends on the height of the jamming antenna. Although the average range is about 20 to 30 kilometres from the antenna tower, it is obvious that the higher the antenna, the greater the distance the jamming signal will travel. Most local jamming antennas are placed on tall buildings, church steeples, or on hills or mountains overlooking the target.

Depending on the size of the area they must cover, and the number of people in it, local jamming stations have between 15 and 50 jamming transmitters. Those are of relatively low power, with ranges from 5kW to 20kW each.

Sky-wave jammers are used to propagate the jamming signals great distances via the ionosphere. They can cover considerably larger areas than the local jammers, and their principal mission is to blanket areas lying in the rural and suburban parts of a target area that lie beyond the range of the local jammers. This is shown in Fig. 2.

Sky-wave jamming transmitters are of much higher power than local jammers, being of the order 50kW to 100kW each. The antenna systems used are more sophisticated (rhombics and log-periodic antennas, compared with low-gain



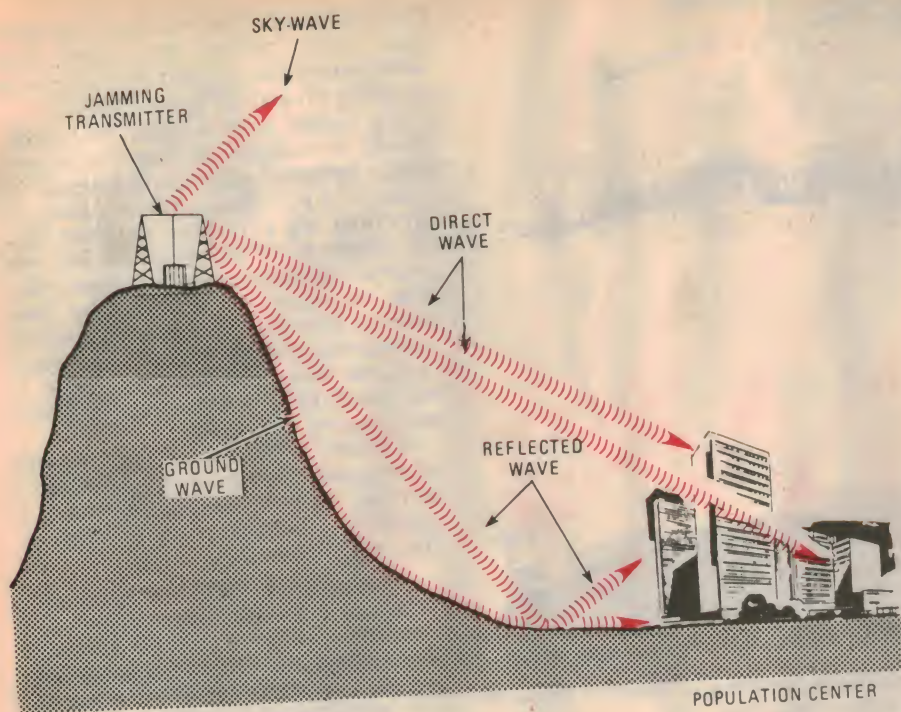


Fig. 1: LOCAL JAMMING consists primarily of a direct wave and a reflected wave. The ground wave is fairly unimportant in this type of jamming.

broadband dipoles employed with local jamming transmitters).

Jamming transmitters are modulated in two ways: *white noise* is produced electronically and covers most of the audio spectrum. It is referred to as noise jamming and is very effective.

In Mayak jamming, distorted program material is transmitted in lieu of white noise. The word *mayak* means "beacon", which is the name of one of the Soviet domestic home service programs. It is not unusual to find three or four simultaneous Mayak transmissions, each slightly out of phase with the others, each distorted, operating on one frequency. They, too, are highly effective.

Over the years, broadcasters whose transmissions were being jammed have tried to overcome its effects in a number of ways. Some of those techniques have failed while others have been highly successful. In order to assess fully the impact of jamming on planning efforts at WARC-83/84, the major anti-jamming techniques will be discussed.

Those anti-jamming techniques include using high power transmitters of up to 1000kW, and high gain, highly directional curtain antennas, by means of which effective radiated powers of more than 100 megawatts can be achieved. That *brute force* technique produces very high signal levels, on the order of five to 10 millivolts-per-metre, delivered to the target areas. Signals of that order of magnitude put considerable strain on the jammers and increase areas in which desired signal strengths are above the jammer noise. That enables listeners to receive the programs.

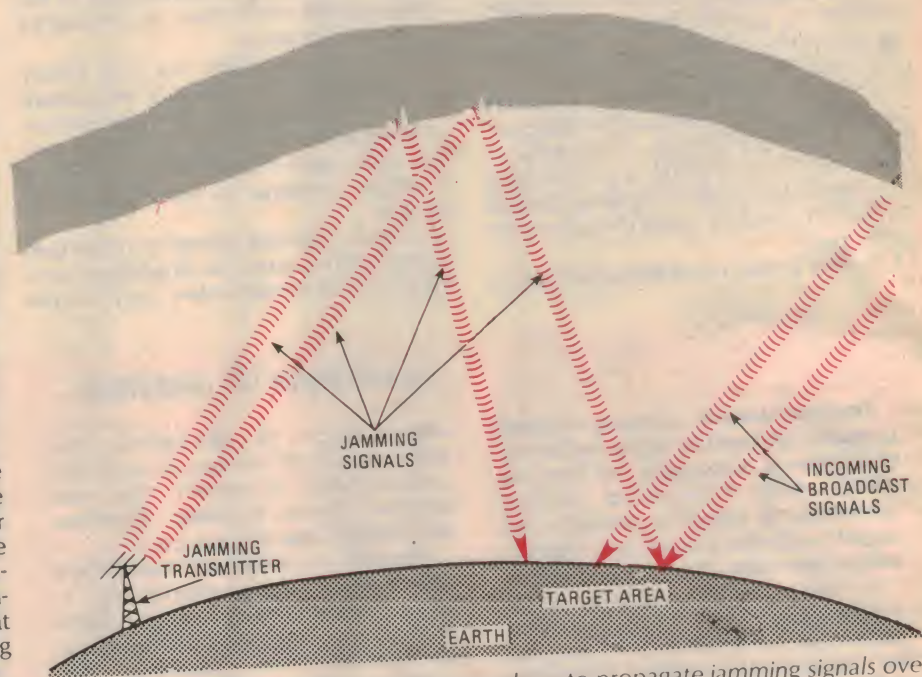


FIG. 2: SKY-WAVE JAMMING uses the ionosphere to propagate jamming signals over great distances.

One of the best methods of countering the effects of jamming is generally known as *saturation- or barrage- broadcasting*, in which as many transmitters as possible — each on a different frequency — are massed simultaneously to carry a particular program. Saturation-programming has been quite successful in putting pressure on the jamming system to the point where some of the frequencies being used to transmit a pro-

gram are either thinly covered by the jammers, or not covered at all.

It is obvious that even in population centres with their own local jamming networks, if more than 15 transmitters are used to carry a program and the jammer complex has fewer than 15 jammers, some frequencies will be clear of local jamming.

In the past, when broadcasts of BBC, VOA, Deutsche Welle, etc were jammed, efforts were made to co-ordinate programming among them so that the maximum number of frequencies were being used to carry jammed transmissions. That method, when used, was highly successful.

Perhaps the most effective method of all for overcoming jamming is the use of a basic shortwave radio propagation technique usually referred to as *twilight immunity*. During the daylight hours the ionosphere is able to propagate higher frequencies than at night. That is so because radiation from the sun produces ions and free electrons in the ionosphere. The range of frequencies the ionosphere can reflect is proportional to the number of those particles. At night, radiation from the sun is cut off and free electrons and ions begin to recombine, resulting in a less dense

ionosphere, which is capable of supporting only the lower frequencies.

It follows, therefore, that a transmitter to the west of a target area will enjoy a period of several hours in the late afternoon (twilight) when the path between the transmitter and the target is in daylight, but the target area itself is in darkness. That is shown in Fig. 3. During that twilight period as many high-frequency transmissions as possible are



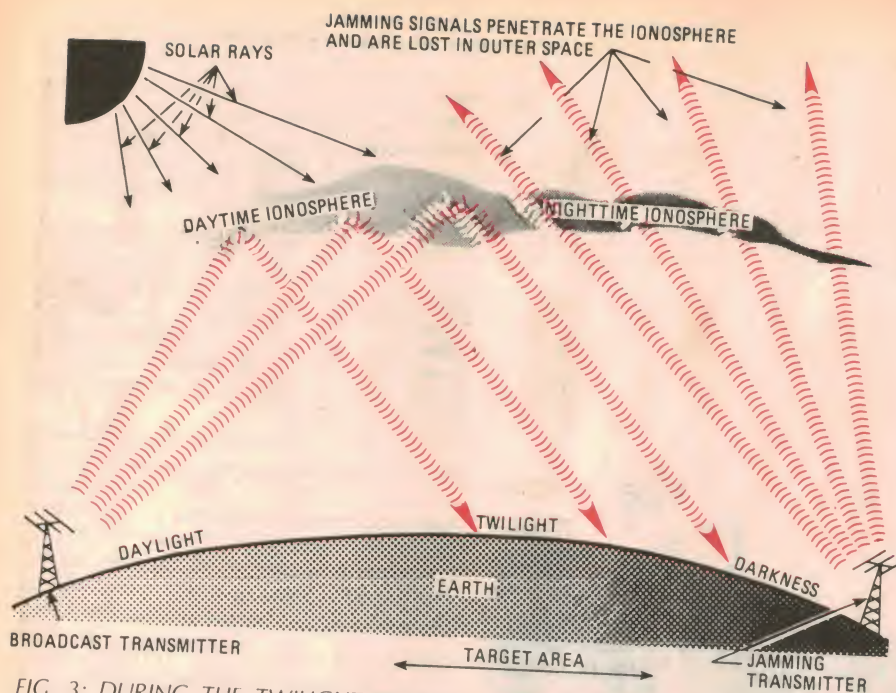


FIG. 3: DURING THE TWILIGHT PERIOD only local jamming is effective because skywave jamming signals are not reflected by the ionosphere.

scheduled. Examination of Fig. 3 shows that jammers operating via the sky-wave mode are relatively ineffective because attempts to use the higher frequencies are generally fruitless, since those frequencies are not reflected by the ionosphere. During twilight immunity periods only local jammers are effective. Since there are literally thousands of jammers, a high degree of effectiveness can be achieved by using the saturation technique.

It is clear at this point that attempts by

WARC-83/84 to develop technical standards or to plan the rational use of the spectrum will be severely hammered by continued jamming.

Preliminary planning for the broadcasting WARC has included discussions of power limitations, limiting the number of frequencies per transmission, protection ratios, and the gradual introduction of single sideband to the broadcasting service.

Evidently, rational planning in the face of jamming is a paradox. In addition, jamming against broadcasters such as the

BBC and Voice of America can resume at any time, since the USSR has demonstrated in the past that it can turn jamming on and off like a faucet.

The United States is eager for the BC-WARC to succeed because the country firmly believes in the rational, equitable use of the high-frequency broadcast spectrum. It is a certainty, therefore, that US planning for WARC-83/84 will emphasise the technical standards and planning necessary to a successful conference. However, it would be naive to assume that the ugly spectre of jamming does not loom over the Conference, or that it will not be a major impediment to its successful conclusion.

At WARC-79 the United States expressed its grave concern about jamming by entering a formal reservation when it signed the Final Acts of the Conference. This reservation states:

"The administration of the United States of America, calling attention to the fact that some of its broadcasting in the high frequency bands allocated to the broadcasting service is subject to wilful harmful interference by administrations that are signatory to these Final Acts, and that such interference is incompatible with the rational and equitable use of these bands, declares that for as long as this interference exists, it reserves the right with respect to such interference to take necessary and appropriate actions to protect its broadcasting interests. In so doing, however, it intends to respect the rights, to the extent practicable, of administrations operating in accordance with these Final Acts."

Reprinted from *Radio Electronics*, March 1981.

## A HISTORY OF JAMMING

The Germans are generally credited by radio historians as being the first to use jamming techniques. As early as 1915, they transmitted random characters to disrupt a radioteletype circuit between France and Russia, which were allies during World War I.

In the 1920s, before radio broadcasting was regulated, some broadcasters deliberately transmitted on frequencies being used by competing broadcasters in an effort to drown out their programs. Although some of the interference caused during those early days was accidental, there is no doubt that much of it was intentional.

The first case of political jamming occurred in the mid-1930s before the German-Austrian *anschluss*. The government of Chancellor Dolfuss of Austria jammed some Nazi-German broadcasts to Austria that were critical of that country. The Nazis themselves

were quick to recognise the effectiveness of jamming to keep out unfavourable comment, and the Spanish, French, Russians, Japanese and Italians soon followed suit.

Jamming increased in intensity and effectiveness during World War II, being used as a military weapon, both to keep out unwanted broadcasts and to disrupt military circuits. The Germans jammed broadcasts of the BBC extensively, and the escape to the open seas of the German warships *Scharnhorst*, *Gneisenau* and *Prinz Eugen*, under the nose of British artillery was possible because the Germans effectively jammed British radar installations overlooking the English Channel.

With the advent of the Cold War after the conclusion of World War II in 1945, jamming flourished to an extent that had not been dreamed of before. The Russians jammed programs in the

Russian language that were beamed to the USSR from Franco Spain and the Spanish, in turn, jammed Spanish language broadcasts emanating from the Soviet Union.

In early 1948, however, a jamming effort was begun by the Russians that dwarfed anything that had been attempted before. In February of that year a dozen or so Russian transmitters were used to jam the Russian language programs of the Voice of America. The Russian language broadcasts of the BBC were jammed shortly thereafter, and by 1950, over 450 such jamming transmitters were in operation.

Although we have no way of knowing for certain, it appears that the decision to launch a massive jamming campaign was two-pronged: first, it was a method of keeping control of the

Continued on p 17



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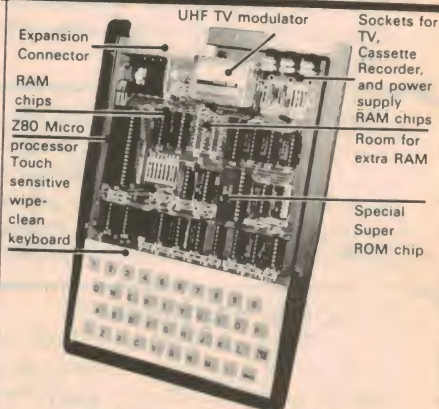
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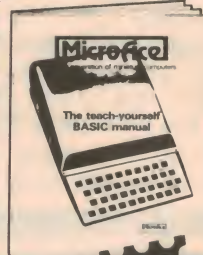
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information monopoly within the USSR, where total censorship of news from external sources was the policy. Second, jamming could be used militarily, as had been demonstrated in World War II, and by operating large numbers of jammers the military jamming machine was kept well oiled.

By the end of 1951, most of the other countries in the Communist orbit had commenced jamming operations of their own against Western broadcasts; and in the beginning of 1952, over 1000 jamming transmitters were in continual operation.

By 1956, between 2500 and 3000 jamming transmitters were in operation against most major Western broadcasters, with particular attention to Radio Free Europe and Radio Liberty, which had begun broadcasting in 1951 and 1953 respectively.

On November 24, 1956 the first break in the electronic curtain occurred when jamming directed against RFE Polish language broadcasts abruptly ended after a series of riots in the Polish city of Poznan, and the coming to power of a new Polish leader, Ladislaw Gornulka.

The Polish press had been complaining vociferously about jamming, and there is considerable evidence to indicate that the people of Poland resented it. That is supported by the fact that during the first hours of the Poznan riots the local jamming station in that city was destroyed.

The hiatus in jamming against RFE Polish language programs lasted 14 years. In 1970, following food riots in

the north of Poland, jamming against RFE Polish programs was hastily resumed. Apparently caught off-guard, Polish authorities ordered that transmitters being used by Radio Warsaw in its external shortwave broadcasting service be redeployed and operated as jamming transmitters. Until jamming transmitters became available, Radio Warsaw's international service was sharply curtailed.

Additional major breaks in the jamming pattern began in June 1963, when jamming directed against BBC and VOA broadcasting in the languages of the USSR, including Russian, were discontinued shortly after the conclusion of an atomic test-ban treaty. That marked the first time in 15 years that those programs were unjammed, and was another indication that a thaw in the Cold War had occurred. In July 1963, Romania stopped jamming all Western broadcasts; in February 1964, Hungary followed suit.

Two months later, Czechoslovakia stopped most jamming of BBC and Voice of America programs, but continued jamming RFE.

However, jamming can be turned on and off at the discretion of the Communist bloc; therefore, the situation proved to be temporary. On August 21 1968, 200,000 Warsaw Pact troops invaded Czechoslovakia and within hours massive jamming of VOA, BBC and Deutsche Welle was resumed. It continued until 1973, when it was again discontinued.

The jamming transmitters no longer being used against BBC and VOA broadcasts were not taken out of

service. Relations between the USSR and the People's Republic of China had worsened in 1973, and many of the jamming transmitters were rescheduled against Peking transmissions in Russian to the Soviet Union.

In addition, the Soviets had launched a major jamming effort against the Voice of Israel whose broadcasts to the Soviet Union called for a more liberal emigration policy toward Soviet Jews — a position not greeted with enthusiasm by the Soviet Politburo.

At the present time, all Radio Liberty programs beamed to the Soviet Union are jammed. In addition, Radio Free Europe programs in Bulgarian, Czechoslovak, and Polish are jammed. Radio Free Europe programs in Hungarian and Romanian are not. Deutsche Welle programs in Bulgarian are jammed and Voice of Israel broadcasts to the USSR in Russian, Hebrew, and Yiddish are jammed, as are People's Republic of China transmissions to the USSR in the Russian language.

On August 20, 1980, the Russians resumed jamming of the Voice of America, BBC and Deutsche Welle. The resumption of jamming, after seven years, was generally thought to be due to growing labour unrest in Poland, and the Russians' fear that it could spread to the Soviet Union. BBC and Deutsche Welle programs in Russian were affected. Voice of America broadcasts in Russian, Ukrainian, Uzbek, Armenian, Latvian, Lithuanian, and Estonian were hit by noise jammers and *Mayak* jammers.

## The "Ten Commandments" of energy debate

Last year, the Council of the United Church of Canada organised a 3-day conference on the moral issues of nuclear power, attended by some 80 participants. The conference chairman laid down the following ground rules for the conference:

1. Thou shalt not attempt to resolve energy issues in isolation from those who have technical knowledge.
2. Thou shalt not use the Bible as an answer book.
3. Thou shalt recognise the close relation between facts and values, objectivity and subjectivity.
4. Thou shalt not evaluate any energy source by itself but always in relation to alternatives.
5. Thou shalt not consider present costs/benefits in isolation from future costs/benefits.
6. Thou shalt remember that human beings and

nature are inter-related, and there is a connection between what is good for one and what is good for the other.

7. Thou shalt not forget that the edges of ethics and theology are speculative.
8. Thou shalt not forget that the edges of science and technology are also speculative.
9. Thou shalt not worship the atom or sun, consumption or conservation, non-renewables or renewables.
10. Thou shalt lay open, assess and attempt to resolve the moral issues, always bearing in mind that humility and unity in Christ are to be preferred over arrogance and needless strife.

(Adapted from "Atom", publication of the UK Atomic Energy Authority.)







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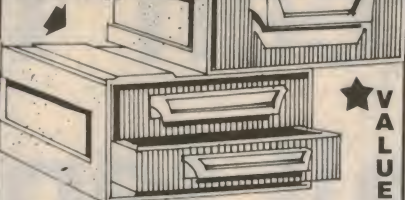
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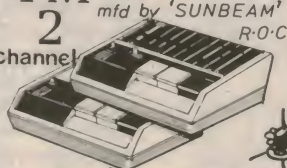
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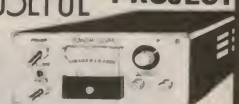
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# Giant screen TV for football fans

Imagine a giant TV "screen" over 13 metres long and 6 metres high! Such a screen is to be installed at the Victorian Football League home ground in July, giving fans on-the-spot an advantage long enjoyed by television viewers at home — instant slow-motion action replays.

by PETER VERNON

"Me go to a football match! Not on your life. You can seem more at home sitting in front of the TV."

Well, up until now, that situation has been quite true. If you missed a moment of action at the game, there was no second chance. Meanwhile, at home, the viewer was treated to three different camera angles, close-ups of the action, and multiple instant replays.

Indeed, some goals seem to be scored ad infinitum!

That situation is about to change, at least for the dedicated VFL fans. Last February, the League entered into a \$6 million sponsorship agreement to install a giant video screen at its home ground

in the Melbourne suburb of Waverley. Among other things, the new screen will provide the crowd with some of the advantages currently enjoyed by the home viewer.

Current plans call for the screen to go into operation on July 1 — well in time for this year's Grand Final. In addition to the score, it will show slow-motion replays of the game, statistics, information on players, scenes from games at other grounds, and pre-match and half-time entertainment features. It can also be used for commercials and promotions, and will in fact display acknowledgements to the seven companies sponsoring the installation.

The contract to install the screen was landed by Steward-Warner Corporation, USA, and followed a three year study by the VFL. Steward-Warner are a leader in the giant video-screen field, with similar screens installed at the New York Giants Stadium, the Texas Stadium in Dallas, the Alhwa Stadium in Honolulu and 16 other locations around the world.

When completed, the new Melbourne screen will be the second largest of its type in the world. The screen itself will measure 13.7 metres long and 6.4 metres high. It will be put together behind the present scoreboard, which will subsequently be dismantled.

The screen is not a normal projection screen nor, obviously, a television screen. The fact that it will be used in the daytime as well as at night rules out the idea of projection, while the sheer size of the display prevents the use of conventional television techniques.

Instead the image displayed on the screen is made up of a matrix of 24,192 individual light bulbs, each bulb forming a tiny part of the overall picture. The intensity of each lamp is controlled to produce a multi-tone display under the control of a computer. Because the intensity of the lamps can be controlled precisely the display can be used even in full sunlight.

However, because the filaments of the light bulbs used take a certain time to heat up and cool down, there is a limit to how fast the picture on the screen can be changed. This limit restricts the screen to slow-motion display only.

Control units developed by Stewart-Warner allow an image to be loaded into memory, verified and transferred to the display board in the correct sequence and with the correct timing to allow an animated or moving display. Programming and control inputs can also be fed automatically from remote sites, allowing spectators at one ground to see the highlights of games being played at other grounds.

Computers are used to control the minute by minute operation of the display, providing storage for messages and images, formatting of character displays and updating of the screen. Data is stored on magnetic tape and recalled as necessary to create particular displays, such as team emblems and company logos.



Video display board at Hong Kong's Sha Tin Racecourse was installed in 1978. The sixteen shade board is shown here displaying the racing club's logo.





The control centre for the display board at the New Jersey Meadowlands Racecourse. Pre-recorded messages and animated entertainment features can be shown, as well as scenes from other sporting events and vital photo-finish shots.

A single giant display board, such as the VFL board, represents a wide range of electronic and mechanical engineering skills. A large array of lamps must be controlled precisely enough to produce a moving, multi-toned display. Each lamp is controlled by an SCR-transistor circuit, similar to a conventional light dimmer. Logic circuitry is used for encoding the matrix so that any single lamp of the array can be addressed, for storing the display data, and transferring the data from memory to the display.

Mechanically, the display board systems are designed for high volume production with automatic equipment and for ease of maintenance. The diffusion panel in front of the display is specially constructed to allow wide viewing angles while minimising glare. In such large structures, environmental testing is an important factor. The effects of stress caused by varying temperatures on different parts of the display, moisture and corrosion effects, mechanical shock and vibration all have to be considered.

The first lamp matrix board designed to display video replays was installed at the Arrowhead Stadium, Kansas City, United States, in 1972. Since then improvements in the technique have allowed a denser picture, with more lamps to a given area, improving both the resolution and the visibility of the display. By controlling the intensity of individual lamps Stewart-Warner produced a 16 tone display — a sort of "brown and white" television — for the Mile High Stadium in Denver, Colorado, in 1975.

The company has concentrated on the development of display systems since 1966. Their displays are designed to be marketed as a range of sub-systems, from simple single panel systems to very large multi-panel designs.



This video replay board at the New York Giant's Stadium is one of two. The boards can be operated in parallel or independently as required by the operator, and show slow motion replays of the game, scores and statistics, and entertainment features before the game and at half-time.

Construction and installation of the VFL screen will cost \$2.7 million, with interest payments and maintenance costs over 10 years, taking the figure to the \$6 million provided by the sponsorship

agreement. Now, thanks, to modern technology, football fans can watch the live action and at the same time see a video replay of the crucial moments of the game.

## A different technique for colour

Dodger Stadium in Los Angeles has a video replay screen installed which goes a step further than that planned for Melbourne. The Los Angeles screen, installed by Japan's Mitsubishi Electric, is 9.2 metres long by 6.5 metres high, and the display is in colour.

Display units using light bulbs produce a "brown and white" video image, and are used chiefly for displaying slow motion shots of the action on the field. The light bulbs continue to glow for several milliseconds after the power is turned off, making them unsuitable for displaying the fast movements of live action video.

The Mitsubishi system works differently. Instead of light bulbs, a specially developed electron beam tube is used. The tube works rather like a small TV receiver tube, except that the tube corresponds to a single tiny dot on the overall display. Each produces only one colour — red, green or blue — at one of 32 levels of brightness.

For the Dodger Stadium display 24,576 tubes are used, arranged in groups of three.

A dot of a particular colour is displayed by lighting the tube of that colour in the correct position on the display screen. The tubes are 10 times brighter than a normal TV screen, so that the display can be viewed clearly even in direct sunlight. In addition, each tube consumes only two watts of power — 10% of the consumption of a display board light bulb.

The display is controlled by a computer which directs the various tubes to light up to form a picture. From a viewing distance of 60 metres, the thousands of tubes merge into a single sharp picture, able to display all the thrills of the live game.



# Electronic aids for the disabled

People who are unable to speak often face lonely and restricted lives, but aids made possible by modern electronic technology are changing this prospect. Now the mute have available a range of devices with which they can compose and display written messages simply and easily, taking advantage of the power of the microprocessor.

by SARAH E. LOMAS\*

Application of microprocessor technology to communication aids for people unable to speak has resulted in a number of developments, including speech replacement devices.

The main requirement for non speakers to be able to benefit from the use of speech aids is that they must be able to understand some form of language. However, because speech loss may be associated with different disabilities — including severe physical handicap — aids have to be designed to meet a variety of other requirements as well.

Non speakers are often able to hear, and therefore need only to replace their own side of a conversation. Advances in this particular field of speech replace-

ment developed from the use of simple letter or picture boards and pointers — a slow but effective method of communication.

The problem is that, apart from being slow, this system requires considerable concentration on the part of the "listener" to pick up the letters and retain them to form a sentence. The new developments allow the sentence to be spelt out — as with a typewriter — and to be recorded at least until the "listener" has understood the message.

A standard typewriter, however, has two disadvantages as a speech replacement device. First — and most important — it does not produce a form of communication which is ephemeral, one of the vital aspects of speech. If the only method of "speaking" is to write, personal communications are very restricted.

Secondly, a conventional typewriter is simply not designed as a speech aid, making it cumbersome and difficult for the "listener" to read the message. In addition, not all disabled people can use a typewriter.

## The Lightwriter

One development which offered a solution, in part, to the problems of non speakers was the Lightwriter. Originally developed in 1973 by Toby Churchill it has now become a sophisticated portable device (see EA December 1975). It consists of a keyboard of microswitches with a key-guard (allowing error free operation by users with poor muscular control). The keys, in a familiar typewriter layout, operate a 32-character movable display panel which can be placed in a position convenient for the "listener" to see. As the conversation progresses, the letters move along the screen, disappearing at the end.

The base unit, consisting of keyboard and electronics, weighs approximately 2.3kg and is designed for use on the lap or on a wheelchair tray with a rechargeable battery pack or a mains adapter. The aid is continually being developed and has been successfully used by disabled adults and children, particularly those suffering from cerebral palsy.

## The Microwriter

Another more recently developed device is Microwriter's electronic writer and communicator. This is a portable microprocessor-controlled device with a touch-sensitive keyboard and a moving 12-character display similar to that on the Lightwriter. As the Microwriter does not have a conventional keyboard, it is necessary to learn the coding system in order to type; however, this is easily learnt in a few hours.

It can be used as a portable communication system, the small keyboard requiring only minimal control of the thumb and one other finger. In addition to producing an ephemeral message of 12 characters, the device also has a memory of up to 8000 characters which can be played back, corrected, edited and typed, using attachments to a 16-line 64-character display screen (or domestic TV receiver) and a high speed printer.

A recent attachment for the Microwriter is a voice synthesiser which



LEFT: phrases can be displayed on the Lightwriter screen by operating the typewriter-like keyboard. Screen is detachable.



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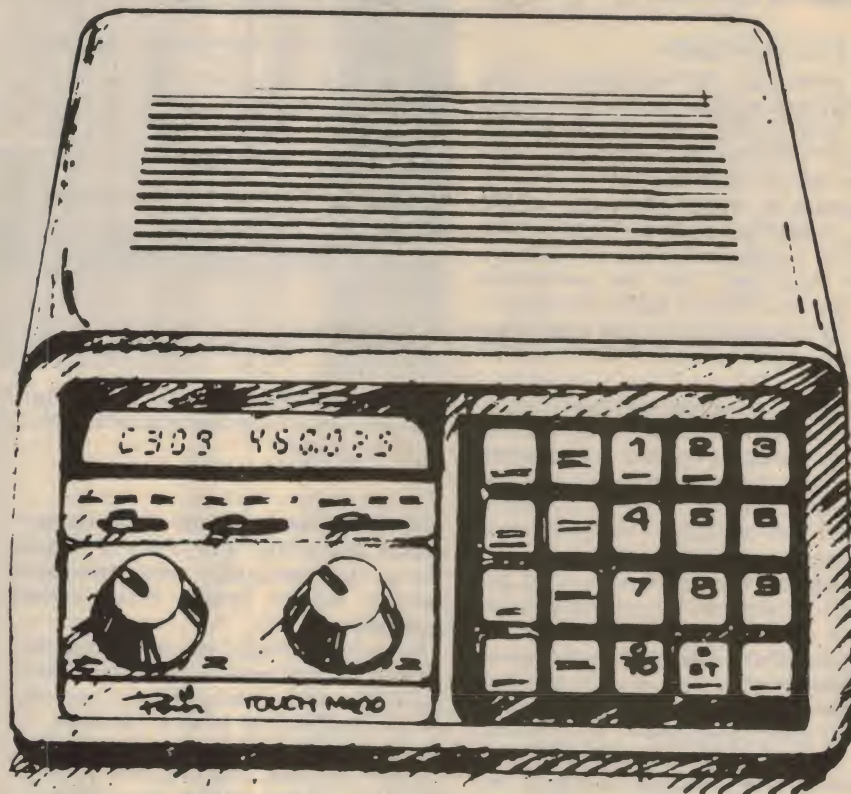
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### Typical Performance

**Frequency Coverage:** 66-90 MHz 144-174 MHz VHF  
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**Sensitivity:** (12db Sinad) better than 0.45uV

**Scan Rate:** VHF 16 per MHz (5KHz Increments)

**Search Rate:** UHF 6 sec per MHz (12.5 KHz Increments)

**Power Requirements:** AC or DC operation.



The Microwriter, therefore, offers not only a communication device for the disabled, but can also be used as a word processor and typewriter. It measures  $216 \times 102 \times 57$ mm, weighs only 0.7kg, and is battery operated.

The keyboards of the Microwriter and the Lightwriter may require too much finger control for some severely disabled people — who may be able to use only a single switch operated by mouth or movement of some other part of the body. With this in mind, Possum Controls has developed its Communicator. These machines can be connected together, and there is facility for two inputs, so communication can take place between two severely handicapped people.

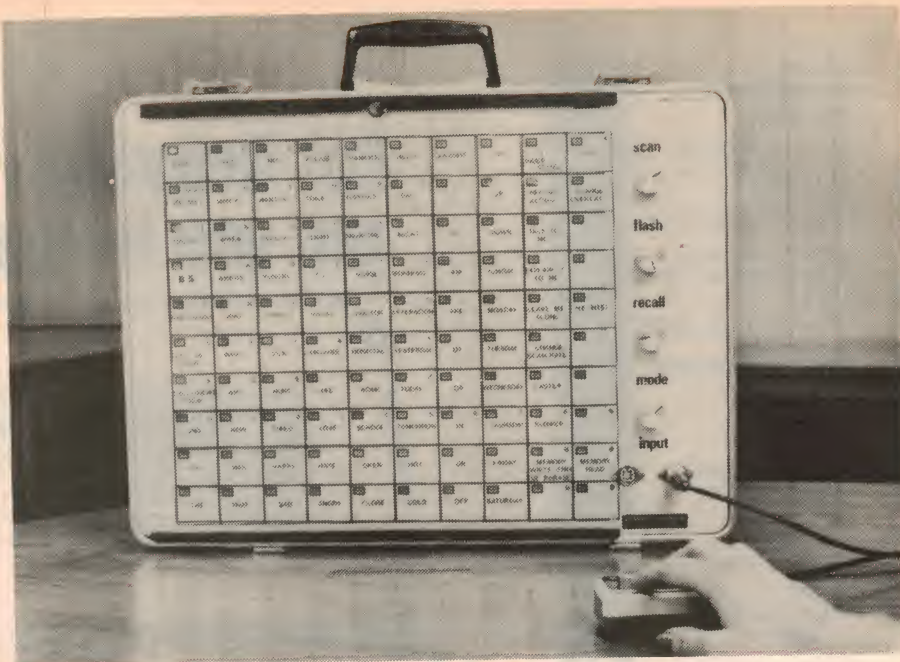
Inputs include single microswitch control or mouth operation by suck/blow. The input switches operate a light switch which scans a communicator panel consisting of 100 calls. The scan can travel vertically, horizontally or diagonally to illuminate any cell required.

Transparent overlay sheets which slip into the front panel are provided, enabling the unit to be used for a variety of purposes. These include relevant words and symbols as well as the standard alphabet. The four sheets issued cover general communication – food (eating and shopping), clothes (dressing and shopping) and a simple alphabet and symbol sheet. Blank sheets can be provided for users to create sheets to meet their own needs – for example, using symbols or sign language.

The language unit includes a "call cell" which sounds an alarm to attract attention. The Communicator also contains a memory facility enabling it to store up to a 40 cell message. A pre-set phrase can be held in the memory and recalled as required.

The unit is enclosed in a briefcase; with an overall size, including rechargeable batteries of 483 x 356 x 108mm.

Another keyboard development is the Splink communication aid from Medelec. This differs from the keyboard systems of the Microwriter and Lightwriter in that it consists of a large word board —  $660 \times 480\text{mm}$  — containing some 1000 basic words, letters of the alphabet and elementary phrases, linked via a microprocessor to an ordinary television receiver. Some of the vocabulary can be adapted and personalised during production for individual users. Simple finger pressure on any of the segments of the word board causes words and symbols to be displayed on the television screen.



The Possum Communicator can be operated by a microswitch or by sucking and blowing into a tube. The input controls a moving light which illuminates the required word or phrase.


The words and phrases speed conversation, and using several word boards via a microprocessor and television screen makes group conversation possible.

The microprocessor and software editing facilities ensure that only whole words are shown on one line. Once the whole display area is filled (16 lines, 32 characters a line) a simple scrolling system operates, enabling the message to continue. The system also includes a memory of up to 110 words which can be recalled.

The unit has been developed in close cooperation with Frenchay Hospital in Bristol, Western England, and has been

Readers requiring further information on any of the devices mentioned in this article should contact the following companies:

- Toby Churchill Ltd, 20 Penton St, Cambridge CB2 1HP, England.
- Microwriter Ltd, 7 Old Parl Lane, London W1Y 3LJ, England.
- Possum Controls Ltd, Middlegreen Trading Estate, Langley, Slough SL3 6BX, England.
- Medelec Ltd, Manor Way, Old Woking, Surrey, GU22 9JU, England.

tested with patients from six to 63-years-old, at home and in hospital. 

Writing microprocessor programs on blank or plain ruled paper is messy and time consuming. To make the job easier, Electronics Australia has produced these custom-designed programming sheets for use with virtually any microprocessor system. The sheets feature columns for a 4-digit address, up to six digits of instruction code or data, labels, mnemonics, and comments. There is space for 46 lines per sheet, and the sheets are provided with space for program title, date and sheet number. They are also punched for filing in a standard ring binder. All for less than 5 cents per sheet, posted!

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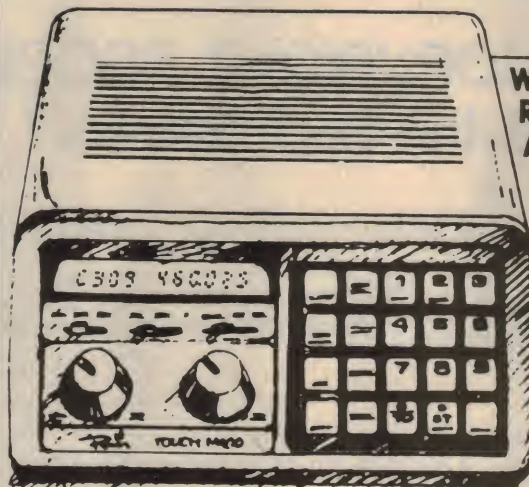
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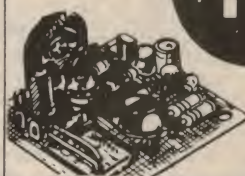
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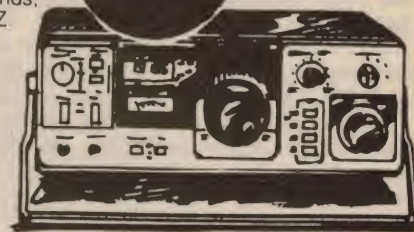
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# FORUM

Conducted by Neville Williams

## THE AUDIO/VIDEO COPYRIGHT PROBLEM . . . is a levy on cassettes the best answer?

During recent years, advancing technology has made it possible for individuals to copy documents, sound recordings and video material with the greatest of ease. In the process, it has focused a lot of attention on the legal aspects of so doing and, at this stage, nobody quite knows where it is all going to end.

The above introduction was prompted by a circular to hand from the recently formed Audio Visual Distributors Association, with headquarters at 107/302 Walker Street, North Sydney. According to the circular, the inaugural meeting was attended by "all the major organisations involved in the distribution of audio-visual media, especially film and television material". Commercial enterprises and State funded Film Corporations alike were represented.

An attachment to the circular indicates what the Association is about. It emphasises that the Australian Copyright Act 1968 as amended (1979, 1980) confirms the rights of writers, artists, architects, musicians, film-makers, etc.

I quote: "Broadly it (the Act) provides that creative work can only be used in ways authorised by the owners of those works".

The circular points out that one of the "uses" covered by the Act is that of making any kind of a copy as, for example, of a film. I quote again: "The Act clearly reserves to the owner of the film, the exclusive right to make a copy of the film."

And underlined: "There are no exceptions for education or domestic use".

While receipt of this document provided the immediate motivation for the present article, I am constantly coming up against references to the copying problem in one form or another — having to do with printed matter, audio recordings, video recordings and material as broadcast by radio and television stations.

Add to that letters and phone calls from readers, apprehensive about what they are doing, and we have something that it is no longer possible to ignore.

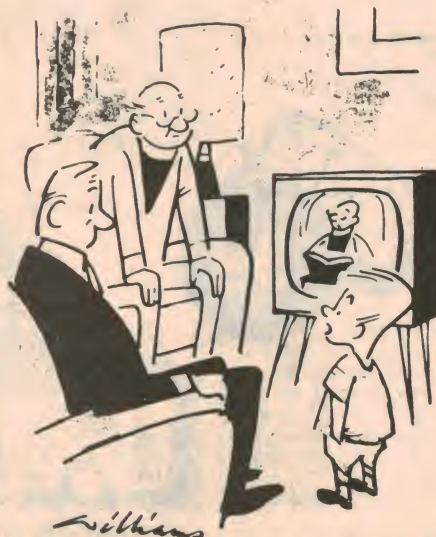
Where do EA readers really stand in making recordings for private use? Or in the role of teacher in a public or private

school? Or as the in-house electronic "genius" for a local church or welfare group?

Ideally, one should be able to offer unequivocal answers to such questions but that is scarcely possible. For sure, there is no shortage of opinion or of assertion — or of challenge thereto.

What is lacking is a practical, unambiguous, legally-based consensus that can bridge the gap between rights and expectations of the owners and the consumers of copyright material.

Right now, copyright laws means different things to different people, depending on what side they happen to be on. Much of it has yet to be tested in the courts. In consequence, interested parties indulge themselves in a great deal of argument, posturing and bluff — everything short of actual legal fisticuffs!



"Rev. Borem . . . how do you stop people from taping your sermons?"

In saying this, I am not referring to blatant cases of large-scale, commercial "pirating", where equipment and stock have been seized and the offenders heavily fined. For this kind of action there is plenty of precedent.

I am referring rather to activities at an individual level, which are so inaccessible that effective pursuit of copyright is next to impossible. The rub is that, with rapidly advancing technology, private activities are becoming a greater liability to copyright interests than the professional "pirates". Hence the mounting concern of those who feel themselves threatened.

Copyright notices commonly appear in books and magazines, on record labels, pre-recorded tape labels, film material and so on. At a personal level, however, we tend to regard such notices as a formality, of no particular relevance to us as individuals.

In practice, if we need to do so, we don't hesitate to make a photostat copy of a few pages of a book or magazine, or a few sheets of music.

If we want a taped copy of a record, we make it, despite the prohibition on the label. If we subsequently want to play the record or the tape in a community situation, we do so, without asking awkward questions.

### A MAJOR PROBLEM

See that situation spread throughout the Australian community — and it certainly is nowadays — and one can appreciate the enormous effect that it is having on the sale of books, magazines, music, records, pre-recorded tapes and now visual material. That means an effect on the viability of publishers, large and small, plus the livelihood of countless writers, composers, musicians, actors, production personnel and so on.

It follows that we are not looking at a mere formality, of no particular relevance to individuals. Rather we are looking at a problem that now has enormous economic and social implications and it is one that is extremely involved, the more so because the frame of reference is — and always has been —





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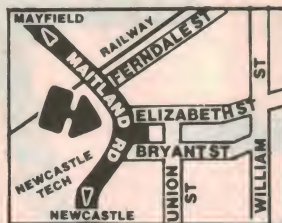
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## New Cannington store

Perth is a growing city. As it grows, so do we. We are pleased to announce a second store has opened in Cannington. The west will never be the same.



## New Springvale store

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## New Auburn store



Auburn is No. 8 for Sydney, and we now provide a service that is within reach of just about everyone. Why not call in and take advantage of the many bargains and direct import prices.

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subject to change with developing technology.

Modern international copyright law has its roots in the Berne Convention of 1886. Amongst many other matters and in an effort to protect a local industry, Swiss delegates sought — and obtained — a declaration that the mechanical reproduction of musical airs be no infringement of copyright. Composers were not unduly concerned because, at the time, the only significant means of mechanical reproduction of music was by music boxes and hand organs, as used by street "organ grinders".

With the subsequent emergence of the phonograph and the player piano, the 1908 Berne Convention saw fit to reverse the earlier decision, on the basis that composers' copyright now needed protection in the face of new developments.

The USA (1909) and Britain (1911) subsequently passed laws to that effect but, to forestall possible monopoly situations, they required that, if entered into by a composer, royalty arrangements covering mechanical reproduction had to be available without discrimination and on the same terms to other companies.

## COPYRIGHT ON DISC

Besides clarifying the position between composers and record manufacturers, the 1911 Act went a step further and conferred a copyright on the record itself, as distinct from the work. Presumably, the intention at the time was to prevent the record being copied by rival companies.

However, in a case decided in 1934, it was held that the manufacturer's copyright included a role in determining the circumstances under which a record may be performed. It became necessary to distinguish between normal (free) "private" use, and "public" performance for which a performance fee was payable to the record manufacturer.

In the intervening 50-odd years, circumstances have continued to change. Sound recordings have become a way of life; the domestic cassette recorder has become a standard piece of hifi equipment; most homes have at least one television receiver and video recorders are currently "taking off" in the marketplace; video discs are only a year away.

Copyright law and copyright administration has simply not kept pace with technology.

As one legally qualified observer remarked to me: "In many of these matters, one could consult half-a-dozen lawyers and get half-a-dozen shades of opinion!"

Perhaps one could add, with some justification, "plus half-a-dozen accounts!"

By way of illustration, a disc recording which I reviewed recently, carried a prominent notice on the jacket which read thus:

# 50 & 25 YEARS AGO

## Wireless Weekly

A pilotless aeroplane, controlled by wireless from which an aerial torpedo can be released ad libitum, has been patented by the Mr Sperry who invented the gyroscope.

A long-felt want has been filled since Liverpool Cable Co introduced a line of woven copper shielding braid. With the careful use of shielded leads it is usually possible to greatly improve the performance of the set, particularly in the matter of hum and selectivity troubles.

Police had to be called out to maintain order when a Boston department store recently began to sell television reception kits, which, like complete television receivers, are becoming more and more in demand as more experimentally-minded persons are turning their attention to this new art.

Of about 19,000 amateur transmitters in America, 84 are women. Great Britain has

two women transmitters, and recently we published an article in which four Australian women transmitters gave their beautiful views.

A prominent scientist was allowed to remark that the atmosphere is full of rubbish; and a London paper added that one needn't tune in to it if one doesn't want to.

Germany's most popular descriptive announcer is on a "reporting" tour through America. He describes America through a portable microphone-amplifier as he goes, and his descriptions are relayed by shortwave to Germany, where they are put on the broadcast band. Not to be outdone, America has arranged for a series of Sunday descriptions from Germany, which will be of Hamburg Harbour, Heidelberg Castle, a trip on the Rhine, etc, and lectures by Professor Einstein, Dr Eckener, etc.

The Cardinal Archbishops and diplomatic representatives of the Roman Catholic Church have been instructed to hold themselves in readiness at certain times to receive communications from the Vatican shortwave station. Receivers for these purposes are being forwarded from Rome all over the world.

## RADIO 16 TELEVISION AND HOBBIES

In these days of modern, high-fidelity record players, the old-fashioned spring phonograph seems a very primitive device. But RCA engineers have dug even deeper into the past to resurrect a hand-driven model!

RCA's hand-driven phonograph is the product of political expediency, which called for some method of getting the Western viewpoint into "Iron Curtain" countries and jungle trouble spots.

Leaflets carried in gas-filled balloons have been used but have limited coverage. Radio, too, is a useful medium but it can easily be jammed by those who don't see eye to eye with the Western world.

Accordingly, RCA engineers came up with a hand-powered phonograph, which it claims can be made for 50 cents or less and therefore delivered gratis to millions of potential listeners behind the Iron Curtain and elsewhere.

It's message cannot be "jammed" and the very novelty of the device would ensure it being used. Even President Eisenhower couldn't resist playing a record "for the fun of it", according to RCA's

chief, General Sarnoff.

Special foreign-language discs had already been prepared for use in Burma, Laos, Thailand, Vietnam and elsewhere, all aimed at describing the freedom which is part of the American way of life.

According to a recent announcement, the Royal Australian Air Force may be equipped with the F-104A "Starfighter", claimed to be the fastest combat aircraft in the world. Details of the new fighter are given below.

Flying on "razor-blade" wings, the F-104A is a day-and-night fighter powered by the new General Electric J-79 engine, one of the world's most powerful jets.

Unmanned rockets equipped with TV transmitters would reach the Moon within the next four or five years, Moscow Radio predicts.

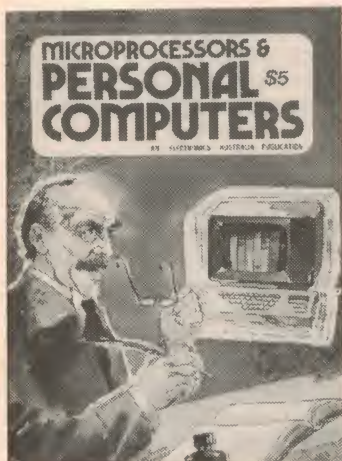
In a broadcast it quoted a Moscow Observatory lecturer saying that such rockets equipped with television transmitters, will make possible a detailed study of conditions met in space flight.

The broadcast added, "As soon as the Moon has been explored the launching of manned rockets and the establishment of a permanent scientific station on the Moon will become a reality.

"A little later — between 1965 and 1970 — exploration of Mars and Venus may be expected to start."



# MICROPROCESSORS & PERSONAL COMPUTERS



Microprocessors and personal computers, little more than a dream a few years ago, are now changing the face of electronics. This book introduces the basic concepts, describes a selection of microprocessor and personal computer systems, and details a build-it-yourself computer designed especially for beginners.

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Available from "Electronics Australia", 57 Regent St. Sydney. **PRICE \$5.00** OR buy mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **PRICE \$5.70.**

## FORUM — continued

All rights reserved. The copying of this recording for any reason including private use is a breach of copyright laws and is strictly prohibited.

I rang the Record Company manager, whom I know personally and inquired as to how sure he was of his ground, in publishing this restriction.

"Very sure", he said.

Faced with mounting losses because of cassette copying, he and some of his industry associates had firm legal opinion to back their position. The prominent notice on the jacket, as distinct from the usual barely readable imprint on the label, is a conscious and deliberate effort to assert what he and his associates believe to be their rights.

However, I had firm assurance from elsewhere that the manufacturer's claim was wide open to challenge.

As a basis, this well qualified person pointed to provisions in the Copyright Act of 1968 whereby "copyright is not infringed by a performance of a recording at any premises where people reside or sleep, as part of the amenities provided mainly for residents or inmates, or if the recording is performed as part of the activities of, or for the benefit of, a club, society or other organisation which is not established or conducted for profit and whose main objects are charitable or concerned with the advancement of religion, education or social welfare".

(So as not to mislead, I should add that the exemptions do not apply if residents or inmates are subject to any charge, direct or indirect, for admission to the performance area. Nor do they apply, in the case of a charitable organisation, &c, if a charge is made to the admission area and any part of the proceeds are diverted to administration, &c, as distinct from the "purposes" of the organisation.)

## A LEGAL LET-OUT

But let's not get bogged down in detail. The aspect to which my informant was moving was this:

When a customer purchases a commercial recording, he acquires the implicit right to initiate performance of that recording of the particular work(s), in premises and situations defined as above by the Act, without breaching copyright.

No requirements are laid down and no limitations imposed on the technical processes or equipment involved in such a performance.

According to my informant, it could logically be argued that, if he wishes to avoid repeated wear on the original recording, the owner has the right to make and use a taped copy as the basis of such performances. Provided he does not use the copy in situations other than permitted by the Act for the original,



he/she would not be in breach of copyright.

If just this one point were to be sustained in court, then the blanket prohibition against copying, as quoted earlier, would have to be significantly qualified. Of course, once copies are made legitimately for private use, it becomes just that much harder to prevent their subsequent misuse.

It could well be that the same principles would apply to the copying of pre-recorded video tapes and in due course, to video discs.

But there is more to it.

In the case of Universal City Studios Inc v Sony (1979) US District Court Judge Ferguson refused to restrain the latter Company from marketing their Betamax VCR, even though all parties acknowledged that it could be used to tape copyright material off-air. His principal finding read, in part:

**Non-commercial home use recording of material broadcast over public airwaves does not constitute copyright infringement.**

While this judgement emanated from a US court and related primarily to video material from ordinary TV broadcast stations, it could be seen as persuasive in other countries and applicable to both audio and video programs. A further right could thus accrue to the home recordist — that of recording and using for "private" purposes material that is broadcast freely into his home.

If justification for this view is needed, it can be said that radio and television stations will have met the copyright obligations for their programs, before offering them freely over the airwaves.

Listeners/viewers have established "private" rights to all those programs in real time. Then why not the right to record them so that they can enjoy them later, at a more convenient time?

What if the home recordist (from disc or off air) lends the tape to another party, so that it is performed outside the recordist's own "private" situations?

That may be quite another matter, but it also raises another awkward question:

Does the purchaser of, even, an original copyrighted item have the unchallengeable right to lend it to a friend? Could it not be claimed that, in so doing, he/she is depriving the owner of the copyright of a royalty payment?

Right now, on my desk, I have a book carrying a notice which would seemingly forbid me to lend it to another person without first obtaining written permission of the publishers.

Whoever heard of anyone being thus deterred from lending a book or a record to a friend or relative? Or of being prosecuted for so doing?

To get back to the real world, I refer again to the circular, mentioned at the outset, from the Audio Visual Distributors Associations. It talks about copyright ownership, prohibitions and penalties and, finally, "How to obtain the

right to copy".

The last par in the circular suggests that advice on copyright matters can be obtained from the Australian Copyright Council, 22 Alfred St, Milson Point, NSW 2061.

From that source, I duly obtained a copy of the 1980 Report of the Committee On Audio And Video Reproduction and Copyright. It is over 12mm thick and there is no way that one could summarise its contents here.

However, the Introduction substantially confirms what I had already written before I sighted it. It makes the point that unauthorised copying of audio material "represents a major loss of income to the record industry, composers and other contributors". It goes on to suggest that the prospect of a similar situation in respect to video material "is having the effect of deferring the establishment of a pre-produced videogram industry."

Of the problem itself, the report summarises it thus:

*The nature and magnitude of home and educational audio and video reproduction makes it difficult and in some cases impossible for copyright owners to exercise their rights under the copyright law. It is apparent that the law does not cope effectively with the new technologies and this Report attempts to suggest improvements in Australian copyright law which, it seems to us, would be in the public interest.*

In seeking practical answers, the widely based Committee appears to have taken a broad view. Again from the Introduction:

*As in all areas of copyright law, we start from the premise that an effective copyright system is accepted to be in the public interest because it encourages the creation of works and the making of records, films and broadcasts. The widely held view is that within that system, there must be a balancing of the needs of the owners of copyright and those who use their works. All of us support the principles of a fair return to copyright owners and of access to creative works and to information.*

Frankly, I did not have time to read and study every word of the report but one thing came through loud and clear:

The only practical alternative to moun-

## Electronic anti-copying?

Despite much thought and research, no foolproof electronic system has emerged which can prevent the copying of either audio or video recordings. Any "foreign" signal intended to defeat copying is as likely to foul-up the performance of a normal amplifier or TV receiver.

Some pre-recorded videocassettes use the "Kopyguard" process which modifies the vertical sync pulse, making copying more difficult. However, overseas reports suggest that the original Kopyguard cassettes are unplayable on about 30% of TV receivers, because of vertical rolling.

ting tensions, confrontations, dilemmas among students and teachers, &c, is an arrangement of convenience:

A small percentage surcharge would be placed on the sale of all blank tapes, probably at their initial distribution points in Australia. This would go to a central collecting agency which would disperse the revenue to copyright owners on a basis to be worked out amongst themselves.

In return, copyright owners would extend blanket permission to individuals to make single copies of their material for private use, along the lines defined earlier.

The surcharge might also cover occasional copies made in schools, within the context of individual teachers and classes for current-year studies.

Recording activities in a school designed to build up a library would have to be subject to documentation and may attract an additional copyright fee.

Similarly for other formalised activities.

Copying for resale would be totally illegal, as at present, unless covered by a negotiated licence.

One could foresee difficulties in the scheme.

The Committee mentions the possibility that the Trade Practices Act may have to be modified to permit such a system to operate.

Again, customers may object to having to pay a loading on tape intended for non-copyright recording. That objection could probably be overcome only at the expense of the whole idea.

## IN CONCLUSION

When I started out to write this instalment of "Forum", I did so with an open mind. Right at this moment, I can't help but feel that a small levy on the price of blank tapes would be the most equitable solution.

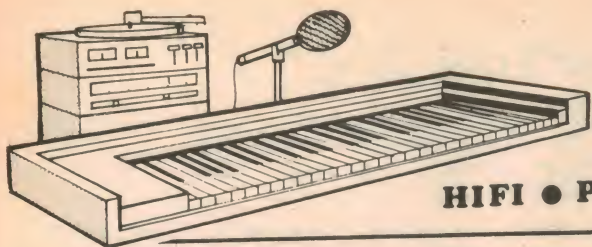
And by "small" I am talking about a very few percent.

It would be worth that to be able to do our own thing at a private level without pangs of apprehension, guilt, remorse, conscience or whatever!

In the meantime, the private copyist remains vulnerable. He may be caught; he may be prosecuted; he may be punished.

Yet again, he may win the case but, I imagine, not without a great deal of expert legal and financial backing.





# AUDIO ~ VIDEO ELECTRONICS

HIFI • PROFESSIONAL AUDIO • ENTERTAINMENT

## National opens its video campaign with VCRs, colour cameras and large-screen TV

by NEVILLE WILLIAMS

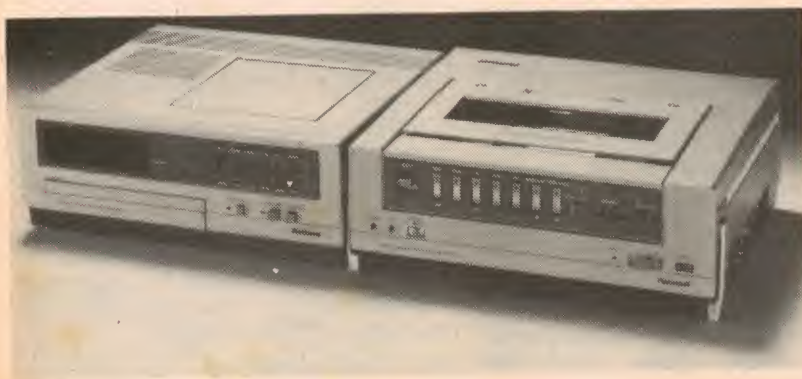
In a tight schedule of almost "personal level" meetings held in major cities around Australia, executives of National Panasonic (Aust) Pty Ltd explained to dealers and to the technical press the Company's big push in video for the '80s. National believes that Australians will take to video, as they did to colour in 1975, and that customer emphasis will be on picture quality.

As distinct from the usual large scale trade launch, with people, products and provender everywhere, the current series of National conferences were in relatively low key — with Company executives and successive groups of visitors sitting around a table and talking about video products and their likely role in the Australian family situation.

Host (in absentia) was National Panasonic Managing Director, Harry

*At right: The National "CinemaVision" 4500 has a 115cm (45in) diagonal screen, with picture projected upwards and forward inside the cabinet.*

*Below: The NV3000 portable VCR (Right) with its mating MV300 programmable TV tuner, cum power supply/charger.*



Yokoi, who was in Japan. His message of welcome was presented from tape, on a National (of course) TC-4500 "CinemaVision" projection TV system.

Perhaps more than any other company, National Panasonic could afford to bypass the usual ballyhoo, because they already have a clear leadership in the world video market. Their purpose, at this time is simply to emphasise the models that currently head-up the National product line, confirm their supply and ensure that dealers around Australia are awake to the marketing opportunities ahead.

Some of the figures quoted were, indeed, startling. In 1979, sales of "home" video equipment in Australia — non-

professional video tape recorders, video colour cameras and tape — added up to about \$37 million. In 1980, the figure climbed to \$60.7 million, up by 64%.

Estimates for the current year look more like \$115 million, made up of \$90m for video tape recorders, \$10m for colour cameras and \$15m for blank video cassettes. For 1982, the estimates are up a further 47% to \$169m, including a significant surge in demand for colour cameras. Yet another increase of 27% is forecast for 1983, to a total figure of \$314m.

These figures do not include colour TV receivers, antennas or other directly associated gadgetry, nor do they take into account a likely surge in the demand

for large-screen TV systems.

The figures are based on trends already observed overseas and on the assumption that demand in Australia will mirror what happened in 1975. In that year, Australia adopted colour TV at a time when most of the "bugs" had been eliminated, but it then proceeded to absorb colour at a higher rate, pro rata, than any other country had done.

A very similar situation now exists with video cassette recorders. Much of the early confusion about systems and models has been resolved and most major manufacturers are now able to offer PAL system decks with proven performance and the ability to meet the normal demands of Australian viewers. The way is therefore open to viewers to invest in a video cassette recorder for family use plus, perhaps, a camera, in the certain knowledge that they can do the job required of them.

A further assumption by the National Panasonic marketing team is that demand in Australia will be responsive to



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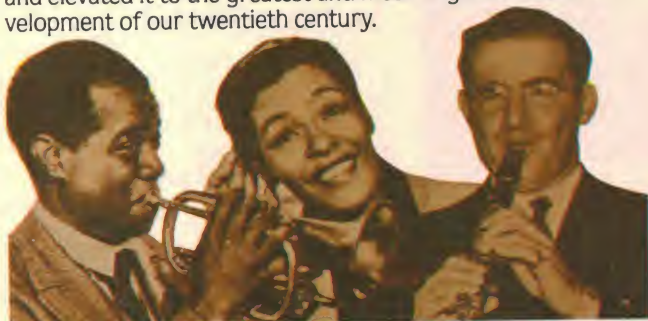
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LIFE  
RECORDS**

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Time-Life International Proprietary Limited,  
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6532.283



# What's new in cassette decks at Sansui?

For starters, you won't find any belts, cams or gears in the capstan drive system of the new D-550M cassette deck. They've all been eliminated in the name of speed precision and transport reliability.

This simplified transport utilizes a newly-developed direct-drive motor for capstan drive. A built-in FG (Frequency Generator) Servo system regulates it with unerring electronic accuracy while a completely independent second motor drives the reels. It's no wonder the wow and flutter specification of the D-550M is one of the lowest in its price range—less than 0.035% (WRMS).

Another new feature is the Dyna-Scape Filter (pat. pend.) that reduces undesirable modulation noise caused by tape vibration at the heads.

The three-head D-550M uses a combination

Rec/Play head for no-compromise performance. Each head has its own amp (complete with a Dolby\* noise reduction circuit) to enable you to monitor recordings as they are being made, Dolby-encoded if you wish.

Sansui gives you other features, some new, some great: backlit light-touch, logic-controlled transport buttons, selectable automatic modes, bias fine adjustment and LED peak level meters with peak hold, much more.

So whether you opt for the 3-head D-550M or the almost as capable 2-head D-350M, you're getting the newest and best in advanced Sansui technology, convenience and sound quality. And that's what counts.

(Black finished versions also available.)

\*Dolby is a trademark of Dolby Laboratories.



**D-550M**

*Sansui*

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168 Japan  
 VANFI (AUST.) PTY. LTD. 297 City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200  
 283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293



performance and facilities, rather than simply to price.

As an indication of this, NPA Deputy Marketing Manager Peter Lee pointed to their NV7000A VCR (Video Cassette Recorder) which boasts top video quality, Dolby sound recording, and an impressive array of control facilities. It has a recommended retail price of \$1500 (somewhat less if you shop around) but, despite this, it has been on "waiting list" ever since its release, some months ago.

Hence National's current philosophy, expressed both in the products coming from Japan and in their Australian marketing emphasis: why cut corners to achieve lower prices, if you don't have to?

Quite obviously, the National team was keen to avoid any prolonged discussion about competitive recording systems. It was conceded that customers may raise the question but too much emphasis on the past could needlessly cloud the present.

The simple truth is that the Australian scene is currently dominated by two major systems, both of them developed in

Japan: VHS and Beta. Unfortunately, they are incompatible because of differences in the cassette design, and further differences within the decks themselves. A VHS cassette cannot be played on a Beta type deck, and vice versa.

Claims and counter-claims are made by the various manufacturers but the potential performance available from the respective systems is directly comparable, as also are the controls and facilities which can be provided.

In both cases, what the customers gets in terms of refinement and facilities is what they are prepared to pay for.

At the same time, National was very happy to be identified with the VHS system, as originally developed by an associated company, JVC. It was also important to stress that the VHS system was in a clearly dominant position in the world video market.

What about all the talk overseas of decks with optional half-speed facilities and extended playing times? Would such models be likely to appear on the Australian market, to confuse the issue?

Mike Elboro, who heads up the Na-

tional video marketing group, doubted that there would be much pressure, for the time being, to market two-speed decks. He claimed that most of the impetus for the multi-speed option had arisen from the early generation NTSC equipment, in a period when limited playing time was a significant problem.

With the latest cassette now available, the current generation of PAL standard VHS decks could offer up to four hours continuous playing time at normal tape speed, and with no risk of diminished performance in respect to either video or audio. Having in mind earlier remarks about customer concern with quality, he felt that there would be considerable diffidence about compromising the end result for the sake of a record/replay time extended beyond four hours.

As it stands, said Mike Elboro, the system is highly compatible with the Australian PAL television system. TV programs can be recorded off air and reproduced through the domestic TV receiver with virtually no discernable change in either picture quality or sound quality.



## The National NV2000A "... works very well"

To assess, at first hand, the utility of a medium-price video cassette recorder, I set up a National NV2000A VCR alongside the domestic TV receiver, with the idea of using it in a family situation, as might any typical (and casual) TV viewer.

Priced at about \$300 below its "big brother" NV7000A, the NV2000A falls somewhere between fully-featured, top-of-the-line VCRs and budget-priced models. Its styling is actually very similar to that of the NV7000A and it uses similar internal "works". Dimensions are the same at 480(W) x 136(H) x 365(D)mm, but it is somewhat lighter at 10kg. Power consumption is a very modest 35W.

The NV2000A has a built-in RF preamplifier, which offers additional gain and makes the antenna signal available both to the VCR tuner and the TV receiver. Both can operate simultaneously but independently, if desired. The VCR's own tuner is an 8-channel, pushbutton varicap system, incorporating automatic frequency control and covering both VHF and UHF. Preset tuning adjustments are readily accessible under a hinged lid and, by observation, tuner performance is excellent. As currently supplied, RF output from the VCR is switchable between Australian channels 0 and 1.

The RF preamplifier is operative whenever the VCR is plugged into a live power point, as is the 24-hour digital clock, showing day, hours and minutes. The clock also functions as a timer, which can be preset to record any program within the following 14 days, or the same program each day for up to 14 days. The programming routine is simple, once you get the hang of it, and does not interfere with normal use of the TV receiver. A normal tape counter is provided which, if used systematically, permits the user to keep track of where everything is on the cassettes.

The top-loading cassette mechanism is very smooth and will accommodate all standard VHS video cassettes, including the latest four-hour types. Touch buttons provide: rewind, stop, fast forward, play, record and pause — the lat-

ter providing a freeze frame effect on replay. In addition, a quick/slow button permits replay (without sound) at five-times or one-fifth normal speed. No video or audio signal adjustments are provided — or necessary — for either record or replay, signals in and out being "tailored" automatically to optimum.

As distinct from recording off air, the NV2000A can be used with a colour video camera, inputs being provided for video, audio and camera control. However, my main concern was with recording off air.

How did the deck work? In three words: very well indeed. While recording must produce some loss of definition, some increase in "noise" and some colour shift, none of these effects were at all apparent. For all practical purposes, the final picture was "as broadcast". The same could be said of the sound, as heard through the TV loudspeaker.

As is normal with VCRs, the freeze frame mode showed some streaking and jittering, as did the five times fast/slow modes, but they readily allow users to pick their way through the tape or to skip through adverts, as the case may be. However, in the most common role of recording shows for viewing at a convenient time, and thereafter to be erased, facilities like this are of of secondary importance, anyway.

In summary, for the viewer whose prime requirement is to timeshift programs for more convenient viewing, or to make a few tapes for use in longer term, the NV2000A will do the job without fuss and without any apparent loss of quality.

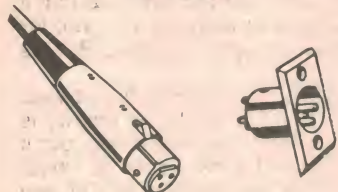
For further details of the NV2000A or other video products inquire at National dealers around Australia or to: National Panasonic (Aust) Pty Ltd, 95 Epping Rd, North Ryde, NSW 2113 (WNN).



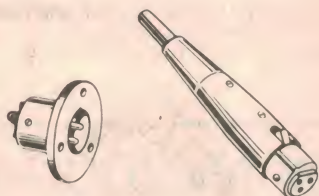


## CONNECTORS & ELECTRONIC COMPONENTS

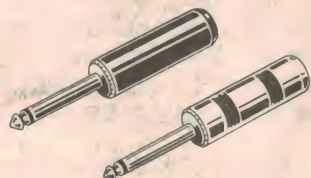
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Tel: 44 6328

## AUDIO-VIDEO ELECTRONICS — continued

Coming to the actual equipment in the National range, the top-of-the-line NV7000A has already been mentioned. It is claimed to be the most compact, full facility deck available, featuring a die-cast chassis for rigidity and four quartz locked direct-drive motors for speed precision. Heads are of hot press ferrite.

Features include a moisture indicator, counter/memory system, clock/timer with battery back-up, 12-channel VHF/UHF touch tuner, 14 day/8 program timer, auto editing, auto rewind, double Dolby audio noise reduction, auto still compensation, and so on.

Optional full-function remote control units are available, one cord-connected, the other using infrared. In addition to channel change, the units offer full tape control: record, play, fast forward, rewind, stop, pause, review (x9), cue (x9), half speed play, double speed play, still and still advance. For more details than that, best you get a brochure!

For those who may balk at the high cost of the NV7000A VCR, National are now offering the NV2000A retailing at about \$300 less (rrp \$1200, somewhat less if you shop around).

To create the margin, National have omitted some of the user "frills", notably the elaborate remote control options and the very comprehensive 14 Day/8 program facility. But the basic structure and circuitry of the deck is similar so that the quality of the video replay is virtually identical to that available from the top-of-the-line NV7000A. (We have more to say about the NV2000A elsewhere.)

Both the NV7000A and NV2000A can operate with video cameras but, for those who want to use a video camera in the roving, outdoor manner, National



The middle-of-the-range National WV-3000 colour camera, claimed to be the most compact and lightweight available with built-in electronic viewfinder, colour correction unit and boom microphone.

offer their NV3000/NV300 combination.

The NV3000 is virtually the record/play section of an NV2000, proportionately reduced in size, fitted with a carrying handle and provided with facilities for 12V DC operation, at a very modest 5.6 watts. Assuming one spare rechargeable battery pack, it offers up to two hours of continuous outdoor recording from camera.

For use in the home situation, the NV3000 can be mated with a matching NV300 programmable TV tuner similar to that in the NV7000 VCR. The tuner includes provision to power the NV3000 deck and to re-charge the batteries automatically. It thus doubles as a complete home VCR system.

If the tuner is not required, an NV-B30 power supply/charger is available for home use.

## Australian HiFi & Video Shows



For the first time the words "& Video" will appear in the 1981 series of "Australian HiFi & Video Shows". VCRs, wide-screen TV, portable TV cameras, &c, will feature alongside the latest model audio systems ranging in price from \$400 to \$10,000. The first show in Sydney will also see the debut of the mobile "Century of Sound" music museum, pictured above. The Sydney show will be at Shore Motel at Artarmon: July 3 noon to 10pm; July 4 10am to 10pm; July 5 10am to 6pm. Adelaide will follow at The Town House, Hindley St: Aug 21 noon to 10pm; Aug 22 10am to 10pm; Aug 23 10am to 6pm. The Melbourne show at the Southern Cross Hotel will be the largest of the series: Sept 11 noon to 10pm; Sept 12 10am to 10pm; Sept 13 10am to 6pm.



At 6kg (with battery pack) the NV3000 is in no sense a lightweight portable unit but National emphasise its multi-role design, and the fact that it uses standard VHS cassettes will full colour 240-line resolution.

Three separate cameras were on display and recommended for use with the various VCRs.

At an RRP of \$1600, the WV-3200 is intended for the "neo-professional" enthusiast. It has adjustable handgrip and shoulder mount, 6-times zoom/macro lens, detachable electronic viewfinder with instant playback provision, backlight and colour correction, boom microphone, automatic iris, external mic input and ratings of 100 lux/43dB/240 lines.

The WV-3000 camera retains the electronic viewfinder, and the 100lux/240 line rating but is structurally simpler with F1.8 lens, 3-times manual zoom and provision for external microphone. RRP is \$1300.

The WV-2600 is claimed to be the lightest available video colour camera, weighing only 1.4kg. It has a through-the-lens viewfinder, auto iris, 100 lux rating, F1.8 zoom lens, 240-line resolution with 45dB S/N, built-in and external microphone provision and sky filter. RRP is \$1100.

Demonstrated at the conference, the cameras were able to produce recognisable pictures in an hotel suite lit only by a couple of table lamps. The light intensity was far lower than would be the case in any ordinary domestic situation.

To display the pictures during the demonstration a TC4500A "CinemaVision" receiver was used, facing across the room from one corner. It takes the form of a tall, single unit cabinet, inside which the image is projected upwards from floor level, on to a 45-degree mirror and thence to the rear of a translucent screen. It allows comfortable viewing of tapes or TV broadcasts in a large room but, at around \$4000, it calls for an appropriately large bank balance.

If you want still bigger and still better, you could consider the TC6200A CinemaVision receiver at around \$5000!

As a mere editor, I would have been much more interested in the VZHT8, at around \$180: an optical box of tricks on a stand which can accept the image from a slide or movie projector and feed it into a video camera. That way, you can transfer your slides and/or films to video tape for fuss-free viewing.

## In brief

CONCEPT AUDIO PTY LTD have announced a new Mark II model of the well-known Pixall record cleaning device. Essentially a roller, coated with a special adhesive tape, it is claimed to remove particles lodged in the groove, as well as from the surface. RRP is \$19.95. Details from Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale NSW 2100. Phone (02) 938 3700.

# HIFI-STEREO ON THE MOVE . . .

In a climate of elaborate, high-technology products, it is interesting to see the mushrooming of a quite different hifi sub culture — the use of small go-anywhere stereo players which can provide high quality music for one or two people through very lightweight headphones.



In Japan, the fad was triggered by the release of Sony's "Walkman", and an array of comparable models soon appeared on the market.

In Australia, Toshiba stirred a lot of interest with their KT-S2 player, reviewed in our February '81 issue. Like Sony's "Walkman" it could play stereo cassettes but it also provided a plug-in tuner capable of picking up stereo FM radio.

National's new RS-J3 "Stereo Sound Machine" follows the original cassette-only concept and was photographed, as above, while the model was roller skating. National stress, however, that it has provision

for "Line Out" and DC input, so that it can double as an extra tape source for a domestic amplifier system. RRP is \$149.

The HC-300S from Sydney-based Hanimex Pty Ltd (pictured below) is also for cassette playback only but it has provision for two sets of headphones. Like the National RS-J3 and Sanyo's M-5550, pictured in the April issue, the Hanimex HC-300S has an in-built microphone that can monitor conversation without having to remove the headphones. The price is \$99.00.

◀ National RS-J3 Stereo Sound Machine  
Hanimex HC-300S Stereo Player ▼



## AND "FM STEREO BOY" . . .

A completely different approach to personal stereo listening is represented in the "FM Stereo Boy",

pictured below, which has just been released in Australia. It has no provision for cassette replay but depends for its music on the FM stations. The distributors emphasise that battery running costs are only a fraction of that for a cassette player. It operates from three AA (penlite) cells.

The FM Stereo Boy is finished in metallic blue and comes with a protective pouch and an easily fitted belt clip. Two pairs of headphones can be used.

Tested in the Sydney area, the unit gave excellent results, using only the antenna wire which is incorporated in the headphone leads. FM Stereo Boy is distributed by Digidial Pty Ltd, Suite 1903 Plaza Tower, 500 Oxford St, Bondi Junction, NSW 2022. Phone (02) 387 5786. Recommended price is \$69.95.





# A pro doesn't fiddle on stage.



The crackle and hum of a loose audio connector is a pain for any performer. Especially when he's up on stage trying to give his best—and he has to keep running back to his amp to wiggle and fiddle a loose-fitting plug.

The Swiss attacked this problem and produced the superb range of connectors from Neutrik (pronounced NOY-TRICK).

They're built as solidly as a bank vault, as precisely as a Swiss watch.

The pins are anchored in high-temperature-resistant materials.

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The cable is tightly gripped, to withstand 100 lbs. of stress. Yet they're simply made and quick to assemble.

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**SANYO AUSTRALIA PTY LTD** have announced a group profit of \$3,131,937 for the 12 months of November 30, 1980. The turnover of \$110 million was 30% up on the previous period. Director and General Manager Mr R. Matsunaga described the result as very satisfying and paid tribute to company staff. Competition will be fierce from here on, he said, but Sanyo will counter this with aggressive promotion and advertising.

**PEPPER STUDIOS** have just invested \$1 million in a new studio complex in Adelaide — at 65 North Terrace, Kent Town. They are looking for a significant expansion in their radio, television and film work. Studio A is equipped with a 24-track computerised sound recording facility, while studio B has a 16-track facility. The two can be interlocked, however to provide up to 40 channels. The studio complex retains the "atmosphere" of its 1930-era buildings but has been completely renovated and air-conditioned to modern standards.

**VIDEO CLASSICS** have released a new low cost system for labelling videotapes, ensuring a neat, professional look. The new "Video Organiser" kit retails for \$10.95 and contains 20 vinyl sleeve covers, plus two sheets of vinyl lettering and borders. A range of colours is available. A lettering guide and tool is supplied, plus instructions. Details from Video Classics, 64 Arthur St, North Sydney 2060. Phone (02) 92 6400.

## TDK Metal Tapes



TDK (Australia) Pty Ltd have reduced the price of their "metal" cassettes which, they say, "have an outstanding capacity to record high level signals without risk of tape saturation or distortion". The "MA-" cassette, in precision moulded shell (top) now retails for \$8.50 for the MA-C60 and \$10.95 for the MA-C90. The MA-R cassette, with diecast metal housing (bottom) is much dearer at \$12.20 and \$15.72. Details from TDK (Australia) Pty Ltd, 4 Dowling St, Woolloomooloo, NSW 2011.

# ALLSOP TAPE HEAD CLEANERS

Whether used for audio, video or data storage, a potential bugbear of any tape system is fouling of the heads by particles scuffed from the tape. Responding to the problem, Allsop Automatic Inc have come up with novel head-cleaning devices for audio cassette decks and VHS-style VCRs.



which the deck switches off automatically.

A stationary pad of felt meanwhile removes unwanted pollutant from the capstan and pinch roller. A bottle of head cleaning fluid is provided for moistening both the leather and the felt.

It should also be mentioned that VHS deck manufacturers, as a group, have questioned the validity of this and other head cleaning devices. They maintain that, if the user sticks to top quality cassettes, frequent head cleaning should not be necessary. Where problems are encountered, the

◀ Left: The audio cassette head cleaner

Below: For VHS type video cassette decks. ▼



The audio cassette cleaner uses a standard cassette moulding which is intended to fit into the cassette compartment of a normal deck. An internal wheel engages the take-up spindle and is driven, when the deck is switched to "Play" mode. In turn, the wheel drives a lever system which causes a felt pad to brush to and fro across the face of the record/play head.

At the same time, a second, spring-loaded felt pad presses against the capstan, with the idea of removing any accumulated deposit.

A small bottle of head cleaning fluid is provided in the blister pack, along with the cassette mechanism; the fluid contains isopropyl alcohol and freon TF. The instructions suggest that two to three drops should be applied to each felt pad and the mechanism allowed to operate in the deck for 20 to 40 seconds.

The makers claim that the use of felt pads ensures that the unit will not contribute to head wear, as might be the case with harsher cleaning tapes.

However, they also point out that the current model is suitable only for machines with a single R/P head.

It is being sold through hifi and tape outlets and retails for around \$7.95.

## FOR VHS CASSETTES

The head cleaner designed for VHS video cassette recorders is also assembled inside a normal cartridge moulding. When loaded into a deck in the play mode, a ribbon of chamois leather is drawn into the machine in the same manner as the actual video tape. The spinning heads rub against the chamois for about five seconds, after

job should be done by a qualified VHS service technician.

By way of rebuttal, Allsop representatives say that, in the real world, cassette users do unwittingly play borrowed or hired cassettes that are subject to oxide shedding. In cases like this, regular use of the Allsop cleaning unit can pick up the deposits before they have a chance to build up on to a scale that might necessitate formal service.

Recommended retail price for the VHS head cleaner is \$34.95 and it is normally available through outlets handling video recording equipment. A model for Beta type decks is being designed but it is not yet available. The sole Australian importer for Allsop tape head cleaners to this country is: Communications Power Inc (Aust) Pty Ltd, PO Box 246, Double Bay, NSW 2028. Phone (02) 357 2022.

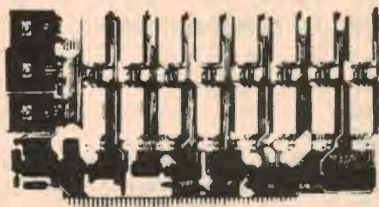


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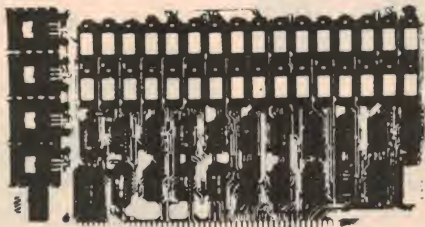
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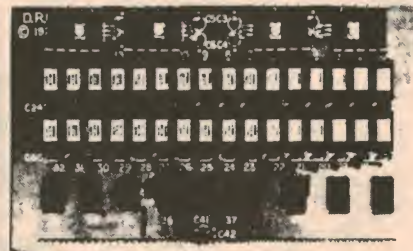
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This 80-column printer provided quiet operation, making it suitable for use in offices, classrooms and homes. Specifications include 125cps, 60 lines per minute, paper loading from bottom or rear and Centronics-compatible, parallel interface.

A bidirectional, dot matrix impact printer with a print head designed for 100% duty operation, assuring a print life that exceeds 100 million characters. The precision sprocket-feed mechanism permits printing forms from 4 1/2 to 9 1/2 inches wide. A 96 ASCII character set prints in upper and lowercase with the added capability of producing double-width fonts in boldface. The vertical format unit provides preprogrammed/programmable tab positions, top of form and bottom of form for complete formatting capabilities.

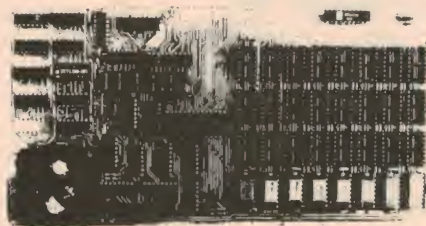


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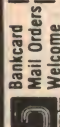
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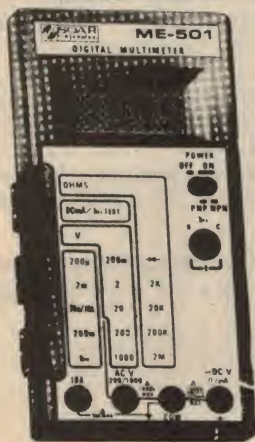
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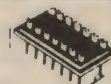
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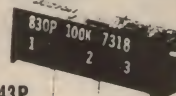
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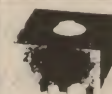


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ACTUAL SIZE

STOCK VALUES  
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2K, 5K, 10K, 20K, 50K, 200K, 500K,  
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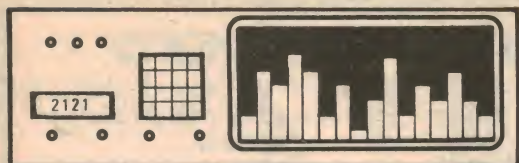
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## Sennheiser 2002 headphones

There is a tendency for many hifi enthusiasts to regard headphones as a second-rate mode of listening. But for many enthusiasts this may be the only practical mode of listening for much of the time. Recognising this, headphone manufacturers have produced a number of very high quality and expensive headphones which are capable of superb sound reproduction. Included in this very select group of headphones is the top of the range Sennheiser, the unipolar model 2002.

Whoever wrote the English translation for the Sennheiser instruction manual was evidently confused about the terms electret and electrostatic. They claim the that the Sennheiser 2002 are the world's first electrostatic headphones without a "diplexer". We assume that refers to a high voltage polarising supply which is required for conventional electrostatic headphones. If this is the case, then the Sennheiser is an electret headphone, a fact confirmed by the use of the word in the French section of the instruction manual.

And just to set the record straight, electret headphones from Japan and elsewhere have been available for at least five years.

In practice though, there is very little difference between electrostatic and electret headphones in that the high voltage polarising supply for electrostatics add very little in the way of cost and almost nothing in the way of bulk to the box which otherwise contains the transformers.

In appearance, the Sennheiser 2002 headphones are impressive. They have large diameter (115mm) earpieces with removable ear surrounds which are very soft and compliant. These have an inner diameter of more than 60mm which means that they will fit comfortably over most ears (human, that is). The earpieces are connected by a large and easily adjustable headband. This, combined with the fact that the earpieces can swivel on two axes, make the Sennheiser very comfortable to wear.

Nor are they too heavy or constrained by too short a connecting cord. If anything, the non-coiled connecting cord of just on three metres is a trifle too long and sometimes liable to be tangled.

It connects via a polarised four-pin plug to the HER-2000 step-up transformer box which is heavy (1.6kg), black and impenetrable. This reviewer finds heavy, black impenetrable boxes a challenge to

his curiosity. However short of physical damage I was unable to open it and it remained a frustrating enigma.

The HER-2000 transformer box measures 184 x 76 x 67mm and is fitted with a 1.5 metre "twinlead" cord ter-

*Pictured at right are the Sennheiser 2002 headphones together with companion HER-2000 control box.*



minated with "piggyback" 2-pin DIN plugs. These are meant to be plugged into the normal DIN loudspeaker sockets on a stereo amplifier while the loudspeaker DIN plugs are plugged into the back of the piggyback plugs. A pushbutton on the HER-2000 then allows the signal to be switched between headphones and loudspeakers. Hence it appears that there really is more "than meets the eye" in those "piggyback" plugs and "twinlead" connecting cord. At any rate, it is an elegant system of connection. We understand that Sennheiser also manufacture a version of the HER-2000 transformer box for those amplifiers which do not have DIN sockets for the loudspeakers.

Another feature of the HER-2000 transformer box is that it can drive two pairs of headphones and, to avoid

arguments between the two listeners, one headset can have the drive reduced by 6dB or 12dB.

Almost unusual feature of the Sennheiser phones is the protection circuitry incorporated in the HER-2000. This limits the drive to the headphones when the sound pressure level exceeds 117dB. This is to protect the headphones rather than your ears but Sennheiser point out that prolonged exposure to such levels is inadvisable. LED overload indicators operate whenever the protection circuit is activated.

Sennheiser recommend the use of an amplifier of at least 15 watts per channel

with an upper limit of 150 watts per channel.

Because of their open-air construction, the Sennheiser phones do radiate some of the program to others in the same room but this is rarely a problem. By the same token, the listener is not isolated from external sounds, which can be an advantage in some situations but not in others.

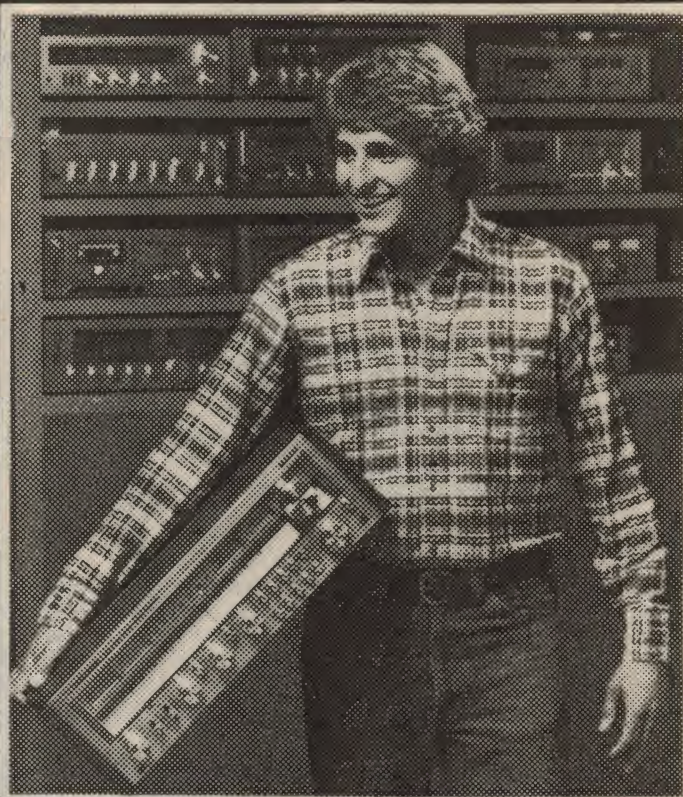
Listening tests confirm that the Sennheiser headphones are capable of really good sound reproduction. The frequency response is claimed to be 16Hz to 22kHz (with no limits) and in practice, it clearly extends to the limits of audibility at both ends of the spectrum. Our only quibble was that the extended high frequency response does lead to ap-

*(Continued on page 149)*



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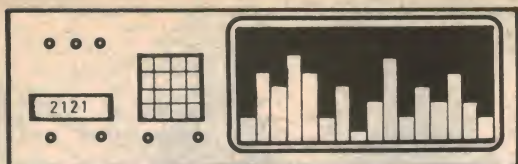
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# HIFI REVIEW

## Harman-Kardon hk570i receiver

Attractively designed in contemporary style, the recently released Harman-Kardon hk570i Stereo Receiver is above average in quality and performance. With a rated power output of 45 watts per channel into 8 ohm loads, it comfortably produces 55 watts at lower distortion than that specified by the manufacturer.

Produced in Japan, the hk570i has the characteristic Harman-Kardon solid construction coupled with the high-quality finish that we have come to expect from this manufacturer. Normal control functions are looked after by pushbutton switches and rotary controls, whilst the usual "straight-line" dial is provided for AM and FM station tuning. When power is applied the cursor is illuminated in an attractive green colour.

FM and AM signal strength is shown on a five-segment bar graph display situated in the top left-hand corner of the front panel, whilst "station lock" and "stereo" indicators are provided by LEDs just to the right of the signal strength meter. A good feature is the provision of two red

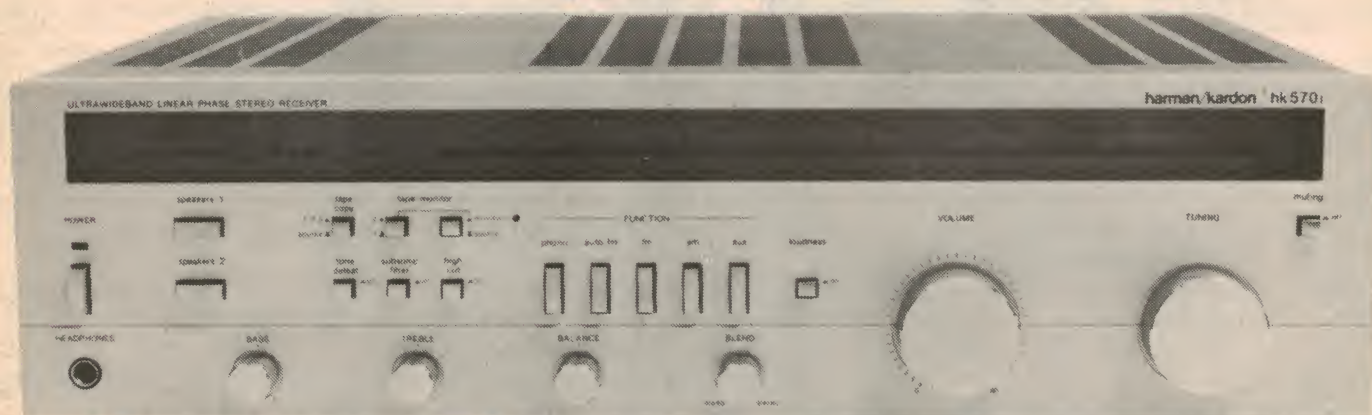
end of travel they are fully mixed in the normal mono configuration. Harman-Kardon suggest that, if the separation between the loudspeakers is greater than the distance from the listener to a point midway between the loudspeakers, then by applying a controlled amount of "blend", a beneficial improvement to the stereo imaging will be attained.

As well as an AUXILIARY input pair, full facilities for the connection of two independent tape decks are included. The usual switched SOURCE/TAPE MONITOR function is provided (for each machine), and when set to TAPE MONITOR a red LED is illuminated — another nice touch. Recordings from other sources (phono,

panel are located the mains cable and two 2-pin utility AC outlet sockets. To comply with Australian standards, these auxiliary outlets have not only been disconnected, but also have plastic inserts to prevent plugs being inserted into them.

Although the unit is apparently double-insulated — since the rear panel carries the international double-square symbol — it is actually supplied with an Australian three-core cable with the "earth" conductor grounded to the chassis. This is a procedure with which this reviewer thoroughly agrees — from both the added safety angle (where the operator actually touches metallic parts of a device), and also from the point of more effective shielding of the circuitry from external interference (by having the chassis and case tied to "real" ground).

Overall measurements of 440mm wide × 360mm deep (including knobs and AM antenna) × 125mm high conform with those of most other receivers in this price range. Removing the top cover reveals a well laid-out interior with some



LEDs to left and right of the green station lock LED. These greatly assist in tuning to the centre of a broadcast carrier by (singly) lighting up to indicate the direction of mistune. When station lock is achieved, the aforementioned red mistuning indicators are extinguished.

An unusual feature is the rotary "BLEND" control which takes the place of the normal stereo/mono switch. Fully clockwise it provides normal stereo separation, but as it is rotated counter-clockwise the left and right channels are gradually "blended" together, until at the

tuner, aux) can simultaneously be made on the two decks; alternatively the facility to record from TAPE 1 to TAKE 2 is provided. In this mode the user may listen to tuner, aux or phono without interfering with the copying process.

The usual array of RCA type phono sockets for phono, auxiliary, and tape decks are neatly grouped together at one end of the rear panel, whilst easy-to-use spring-loaded terminals providing for two pairs of loudspeakers (switched from the front panel) are located just off-centre. At the other end of the rear

10 to 12 separate printed circuit cards. The power output stages are served by a large heatsink located in the centre of the chassis tray, extending from front to rear. Typical of Harman-Kardon's attention to detail is the provision of a copper strap encircling the windings and laminations of the power transformer, so as to minimise electromagnetic radiation at mains frequency. Neatness of wiring and logical layout should ensure simple servicing should problems arise, although the quality of construction suggests that this should be a rare occurrence.



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## AUTO REVERSE STEREO

No more troubles with turning the tape over at end of play — this unit automatically plays the other side. If you wish to fast forward or reverse the tape then it is easy — the controls lock down and then pop out at the end of the tape. Ideal for under dash installation the unit works from 12V DC negative earth. The 4 IC and 2 diode construction boasts a healthy 8 watts maximum output — enough power for even the most avid audiophile. Can be used with any of the speakers shown below.

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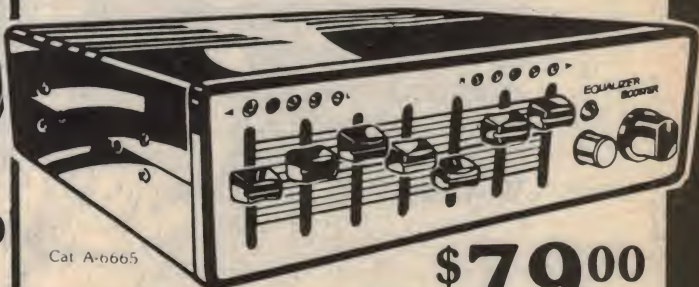
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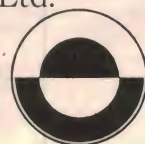
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## HARMAN KARDON hk570i RECEIVER

For the hk570i Harman-Kardon claim a power output of 45 watts per channel into 8-ohm loads with distortion of 0.09% or less. After our standard one-hour preconditioning at 40% of maximum output, we measured output power and distortion, and found that it easily met the above specification. It actually delivered 55 watts per channel (simultaneously) into 8-ohm loads, producing 0.04% distortion at 1kHz, and only rising to 0.08% at 20kHz. For essentially the same distortion it was capable of delivering 36 watts per channel into 16-ohm loads; and with 4-ohm loads it delivered 45 watts per channel.

This was the practical limit for continuous power output into 4-ohm loads, as protective circuit breakers — apparently thermally sensitive — tripped after only a few seconds operation if the power output were increased to, say, 47 watts. After half a minute or so, the circuit breakers automatically reset and restore power. Apparently each channel has its own separate circuit breaker, because interruption of output only occurs in that channel which is "over-driven".

Maximum continuous power output at onset of clipping — with both channels driven — is 68 watts into 8-ohms; and 42 watts into 16-ohms. With only one channel driven, the figures were 75 watts into 8-ohms, and 45 watts into 16-ohms. Because of the action of the circuit breakers, it is almost impossible to incur clipping when driving 4-ohm loads. As usual, all the above tests were carried out using a regulated 240-volt AC source.

As expected, the hk570i's ability to handle square waves was excellent. It was only when the 8-ohm loads were shunted with a capacitor of  $0.1\mu\text{F}$  or larger that a damped oscillation appeared on the top and bottom half-cycles of the waveform. Whilst the magnitude and duration of this "ring" were slightly greater than that produced by a few of the very best amplifiers we have reviewed, this performance is essentially as good as, or better than, the majority of other amplifiers and receivers. Tests for stability with sinusoidal input signals and varying capacitance shunting the load, indicate that the hk570i could be considered to be unconditionally stable.

Frequency response for the Auxiliary inputs is within  $\pm 0.5\text{dB}$  from 10Hz to 25kHz, and is only 3dB down at 70kHz. RIAA equalisation on the phono inputs is within  $\pm 0.5\text{dB}$  between 20 and 10kHz, falling to  $-1\text{dB}$  at 20kHz. Unweighted signal-to-noise ratio for the Auxiliary input is 87dB with respect to 55 watts into 8-ohms, corresponding to 70dB below one watt output. On the phono inputs, the unweighted signal-to-

noise ratio is 75dB with respect to an input level of 10mV at 1kHz, using a typical magnetic cartridge as the input termination.

Phono input overload occurred with 240mV input at 1kHz — a very satisfactory figure, ensuring an adequate safety margin for even the "hottest" magnetic pickups and high level disc recordings.

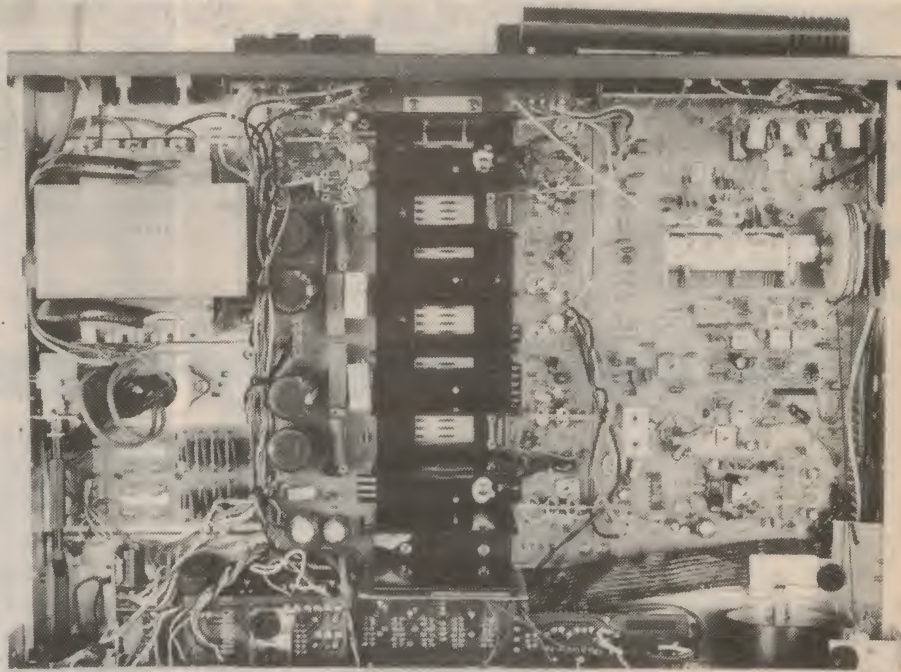
The tone controls which provide the usual "shelf" characteristics at low and high frequencies, can boost or cut the response by at least 10dB at 50Hz; and by a similar amount at 10kHz. A TONE DEFEAT pushbutton enables return to a "flat" response for comparison purposes.

Switched subsonic and high-cut filters are provided, with the subsonic filter only reducing the level by 1dB at 25Hz, thence 3dB at 15Hz and 6dB at 10Hz — a rather steeper characteristic than often provided. The  $-3\text{dB}$  point of the high-cut

straight-line dial measures some 260mm in length, with an effective working range of about 220mm for the very clear cursor.

Above and to the right of this knob is a small pushbutton for selecting the muting facility if so desired. Instead of cluttering the front panel with another control, Harman-Kardon have opted to locate the adjustable muting THRESHOLD control on the extreme left of the rear panel. This is in the form of a screwdriver control, since in practice one finds that it only rarely needs to be altered.

The other controls are the FM pushbutton which selects monophonic FM tuner reception; and the AUTO FM button which is really stereo FM with the usual automatic reversion to mono operation when the RF input level drops below a (manufacturer's) preset level. In the case



filter occurs at 5kHz, with the response being 7dB down at 10kHz, and 12dB at 15kHz. A switched Loudness facility is also included, and provides  $2\frac{1}{2}\text{dB}$  lift at 10kHz, and 4dB at 15kHz. At the low frequency end, the response is boosted 3dB at 400Hz, 6dB at 200Hz, then "shelves" to 9dB at 50Hz.

Interchannel separation was a high 70dB at 1kHz, 51dB at 10kHz and 45dB at 20kHz — a more-than-adequate performance. These figures were essentially the same for both Auxiliary and phono inputs.

Ultimate sensitivity (to produce 55 watts into 8-ohms) measured 150mV for the Auxiliary inputs, and 2.7mV, at 1kHz, for the phono inputs.

Turning our attention to the tuner section of the hk570i, we find that the

of the hk570i this occurs with  $37\mu\text{V}$  input, which corresponds to 47dB of stereo quieting.

Referring to the quieting curves it will be seen that this receiver produces a very good performance, commensurate with many up-market tuners; and is only really excelled by the best of the separate tuners. Note that the RF limiting threshold is reached with some 3 to  $4\mu\text{V}$  input; and that the 50dB quieting figure is achieved for inputs of  $4\mu\text{V}$  mono, and  $50\mu\text{V}$  stereo. "Station lock", ie AFC (automatic frequency control) of the local oscillator, is indicated for inputs as low as  $8\mu\text{V}$ ; which means that for all practical purposes a station is "locked" for any incoming signal which is strong enough to produce an acceptable signal-to-noise ratio.



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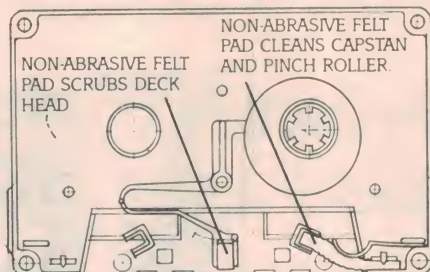


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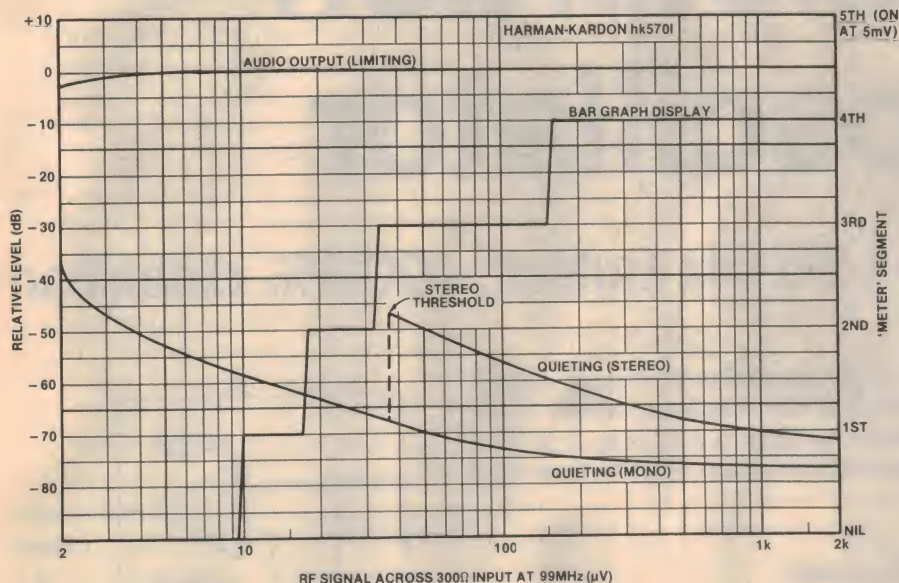
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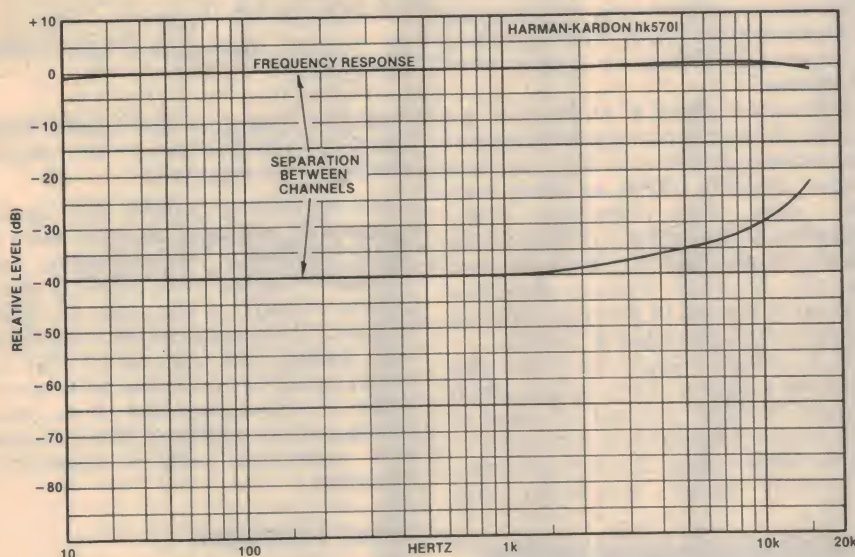
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## HARMAN KARDON hk570i RECEIVER



Above is the graph of the Harman-Kardon quieting characteristics while below is the graph of frequency response and separation between channels.



Harmonic distortion in the stereo mode was found to be 0.14% at 100Hz, 0.4% at 1kHz and 1% at 6kHz. In the mono mode the distortion at 100Hz marginally improved to 0.12%, but remained about the same at 1kHz and 6kHz.

Frequency response was within  $\pm 0.5$ dB between 30 and 15kHz.

If we refer to the accompanying frequency response graph it will be seen that the separation between channels is more than adequate for good stereo reception.

In common with other FM tuners and receivers, the AM facility does not perform very well. The high frequency response is very limited due to the narrow bandwidth of the AM IF stages. Whilst the sound quality of this tuner is,

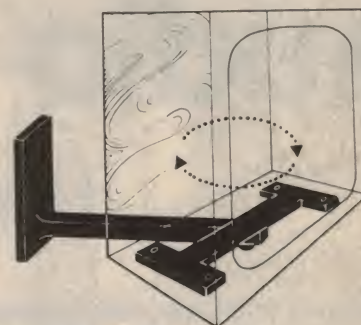
perhaps, slightly better than many others we have encountered, it does not provide high quality AM reception. And while we may sound repetitive on this subject, we still believe that manufacturers should provide better quality AM

Listening tests confirm that the Harman-Kardon hk570i is an excellent receiver, and it can be recommended to anyone interested in acquiring a better than average home "entertainment centre". It combines tuner, preamplifier and power amplifier in the one cabinet, which is not that much larger than either a good amplifier or FM tuner alone.

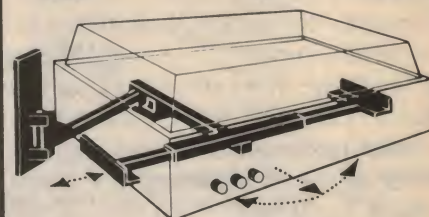
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# A low distortion audio oscillator

15Hz-150kHz output, .003% distortion

This new audio oscillator provides a low distortion sinewave output with a THD of typically .003% and covers the frequency range 15Hz to 150kHz in four overlapping ranges. Square wave output is also provided using a VMOS output stage with rise and fall times less than 20ns.

by RON DE JONG

Audio oscillators are among the most useful pieces of equipment a hobbyist can have, and this is reflected in the number of oscillator projects we have published in the past. These have ranged from complex transistor designs to single IC circuits. Not for many years, however, have we designed a really high performance audio oscillator, and since there are few commercially high performance oscillators available at reasonable cost, we felt well justified in presenting this design.

The frequency range is 15Hz to 150kHz, covered in four overlapping ranges with a variable adjustment in frequency via a calibrated dial. Maximum output voltage is 3V RMS and this can be adjusted down to 1mV via a seven position attenuator with 10dB attenuation steps. Output level is

continuously variable within each 10dB range via an output level control. Output impedance is nominally 600 $\Omega$  regardless of attenuator setting or output level adjustment.

Well so far there is nothing to get excited about, but one special feature of the oscillator design is its low distortion output, typically .003% including hum and noise. The distortion versus frequency of the oscillator is shown in an accompanying graph and it can be seen that the distortion remains fairly low right up to the top of the band where it reaches .014% distortion at 100kHz.

As an added feature we have also provided a square wave output which features excellent rise and fall times of 20ns from a 50 $\Omega$  output socket as well as via the 600 $\Omega$  output. The fast rise times, extremely small overshoot and

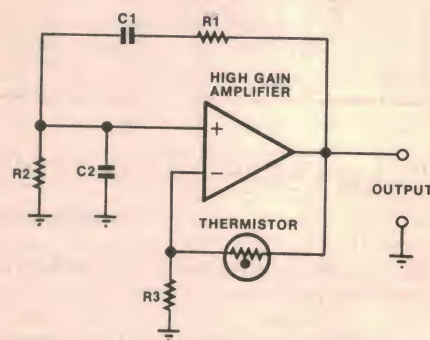


Fig. 1: basic scheme for a Wien bridge oscillator.

minimum ringing of the square wave signal are attributable to the simple VMOS output stage used.

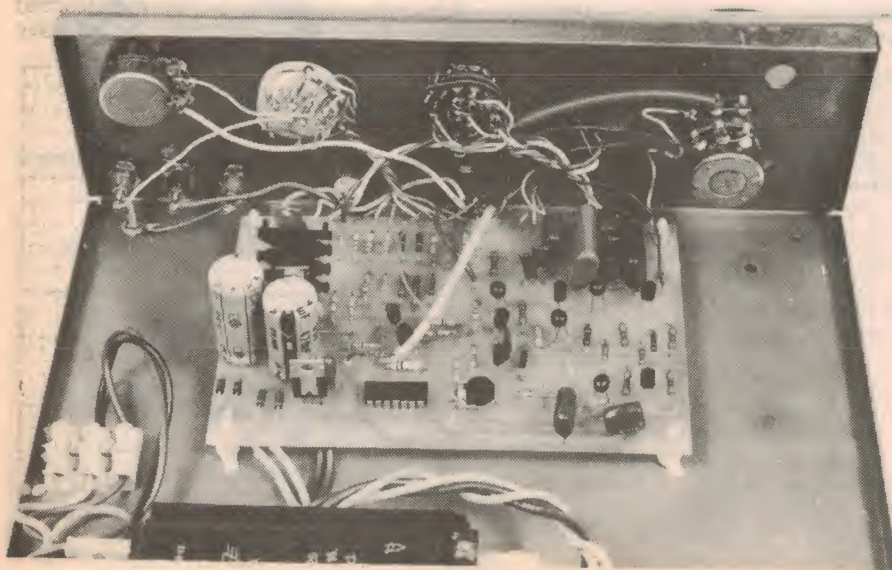
One application of these "fast" square waves is in measuring the slew rates of audio amplifiers. The equivalent slew rate of the square wave output is about 300V/ $\mu$ s which is the sort of figure required to test some modern amplifiers with quoted slew rates up to 200V/ $\mu$ s. Audio signals never approach this sort of figure of course, and the SR is just a measure of an amplifier's ability to cope with transients without generating distortion.

## Circuit description

The circuit uses nine transistors in a Wien bridge oscillator. This configuration offers low distortion plus simplified frequency control and is universally used in high quality audio oscillators.

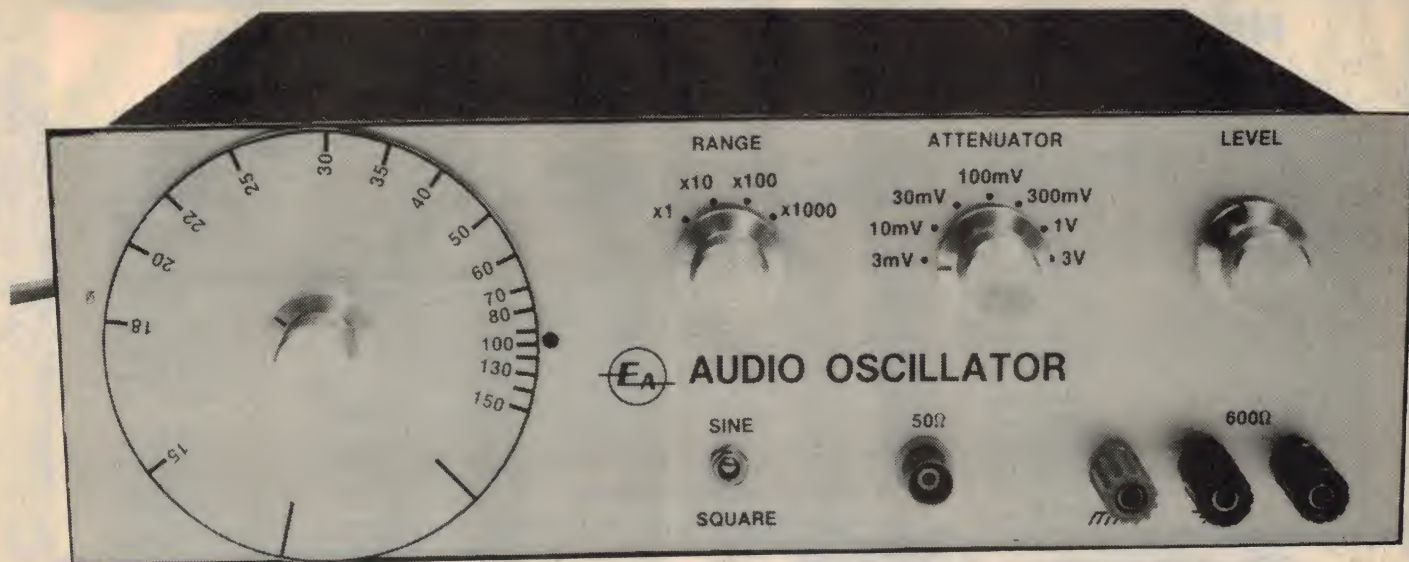
Turning now to Fig. 1, we can discuss the operation of the Wien bridge oscillator. A frequency selective network is used to apply positive feedback to a high gain amplifier. This network is formed by R1, C1, R2 and C2.

At a particular frequency, this network has a "pseudo-resonance", where a signal applied to R1 at the output of the amplifier is transmitted back to the amplifier input without any phase shift,



LEFT: View inside the prototype. Note that the position of the LM320T15 regulator has been altered since this photograph was taken.





and with a minimum of attenuation. In fact, if R1 is made equal to R2, and if C1 is made equal to C2, this frequency is given by the reciprocal of  $2\pi R1C1$ , and the feedback transmission loss falls to a minimum of 3.0.

For a feedback amplifier to produce sustained and steady oscillations, there must be positive feedback with zero phase shift at a particular frequency, while at the same time the overall loop gain must be unity. We can achieve these conditions in the present case by applying negative feedback to give the amplifier a gain of 3.0.

This is the purpose of the network formed by R3 and the thermistor. The thermistor serves a second purpose in this case though, and that is to stabilise the amplitude of the oscillations. If the thermistor was replaced by a fixed resistor equal in value to 2R3, the circuit would oscillate, but the oscillations would continue to increase in amplitude until clipping occurred.

This is obviously undesirable. The thermistor acts to prevent this however, because as the output signal rises the power dissipated in the thermistor increases, and its temperature increases. This causes the resistance of the thermistor to reduce, (it has a negative temperature coefficient), so that the amount of negative feedback is increased, and hence the gain is reduced.

The thermistor also ensures reliable starting of the oscillator, because when there is no oscillation, there is minimal power dissipation in the thermistor, so that the gain of the amplifier is quite high. As the signal level then increases, the thermistor acts to stabilise the amplitude. With the thermistor specified, and the value of R3 used, the final output amplitude is just a little over 3V RMS.

Looking at the main circuit now, transistors Q1 to Q9 form a high-gain amplifier, the 1kΩ fixed resistors and 10kΩ variable resistors from R1 and R2,

while C1 and C2 are selected via switches S1a and S1b. The capacitors are in multiples of 10 from .001μF to 1μF, giving four frequency ranges.

The 10kΩ variable and 1kΩ fixed resistors provide an 11-to-1 variation in resistance and hence frequency within each range. This means that the frequency ranges overlap.

We used a dual 10kΩ linear potentiometer for frequency adjustment because these provide reasonable tracking between the two gangs. This is important because small differences in the resistance of each gang will alter the attenuation of the Wien bridge and hence require a change in the gain of the amplifier. Due to the thermal lag of the thermistor it will therefore take the oscillator a few seconds to settle down whenever the frequency is changed (this is the characteristic "boinging" of thermistor controlled oscillators).

The amplifier itself is a fully complementary design which gives excellent linearity, and because it is complementary, second harmonic distortion is greatly reduced. The circuit consists of an NPN differential pair, Q1

## SPECIFICATIONS

**FREQUENCY RANGE:** 15Hz to 150kHz in four ranges

**OUTPUT ATTENUATOR:** 10dB steps viz 3V, 1V, 300mV, 100mV, 30mV, 10mV, 3mV.

**OUTPUT LEVEL ADJUSTMENT:** 10dB range

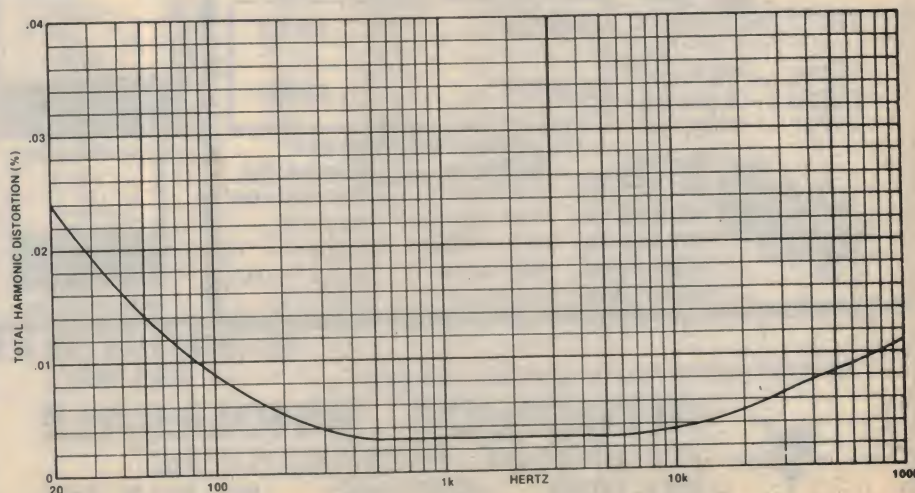
**DISTORTION:** .003% midband, .011% at 100kHz, .024% at 20Hz (see curves)

**AMPLITUDE STABILITY:** ±1dB

**SQUARE WAVE:** less than 20ns rise and fall times

and Q2 and a PNP differential pair, Q3 and Q4. The inputs of the differential pairs are connected in parallel and the output of each pair drives a separate transistor in the output stage.

Each differential pair uses a 15kΩ resistor as a current source "tail". Additionally, 680Ω resistors are included in series with each emitter to improve



This graph plots the total harmonic distortion against the output frequency.



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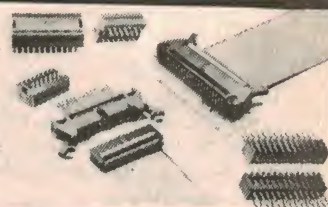
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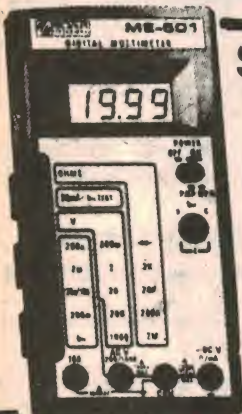
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Output from each differential pair is via a 3.3k $\Omega$  collector resistor with the NPN pair's output driving Q5 and the PNP pair's output driving Q6. The collectors of Q5 and Q6 are in turn connected together via a "V<sub>be</sub>-multiplier" circuit Q7. Quiescent current through each differential pair is about 0.5mA giving a voltage across each collector load resistor of 1.65V which results in a quiescent current through Q5 and Q6 of about 5.5mA.

The output from the collectors of Q5 and Q6 is an amplified and inverted version of the input signal and can swing symmetrically between the  $\pm 15\text{V}$  supply rails. This output is buffered by Q8 and Q9 which form a complementary-symmetry voltage follower.

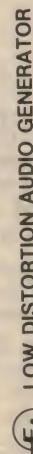
To reduce crossover distortion in the output stage a quiescent current of about 5mA is passed through Q8 and Q9. The actual value of the current is determined by the fixed voltage across the "Vbe-multiplier", Q7 and the voltage drop across the two 22 $\Omega$  resistors due to the quiescent current. Note that, due to variations in the Vbe of transistors Q7, Q8 and Q9, the 1.2k $\Omega$  resistor in the Vbe multiplier may have to be changed to obtain the required 5mA quiescent current. More about this later in the article.

Feedback, as we have mentioned, is via a thermistor in a voltage divider. Rather than use a thermistor by itself however, we have included a  $1\text{k}\Omega$  fixed and a  $1\text{k}\Omega$  variable resistor which permits the output voltage level to be adjusted to precisely 3V RMS. (The output level can be quite easily set using a multimeter since most are calibrated to read RMS value for a sinewave signal.)

Turning to the distortion curve of the oscillator for a moment, note that it rises at both low and high frequencies, being .011% at 100kHz and .024% at 20Hz. Two quite different mechanisms are involved here. At the low frequencies, the thermistor itself generates the distortion because its thermal lag is not sufficiently long, causing its resistance to vary during any low frequency sinewave cycle, resulting in distortion. At high frequencies, the reduced open-loop gain is responsible for the increased distortion.

The square wave signal is derived from the sinewave output firstly by squaring the signal up via transistors Q10 and Q11. These are arranged as a differential pair with one input going to the sinewave output of the oscillator and the other to ground via a 10k $\Omega$  resistor. The 10k $\Omega$  resistor in series with the Q10 base is to reduce any loading effects while the 10k $\Omega$  in the other base reduces the offset voltage due to biasing currents.

Because of the fast spikes associated with the square wave circuit we have





included switch S2a which switches the input of the following square wave circuit to ground for sinewave output, thus disabling the square wave output stage.

Following switch S2a, two inverting Schmitt triggers further square up the signal and provide a direct interface to the final VMOS output stage, Q12. The VMOS transistor we have used is the VN88AF from Siliconix which offers specifications such as minimum transconductance of 150mmhos, gate threshold voltage of 0.8V, maximum Vds 80V and a minimum current rating of 1A.

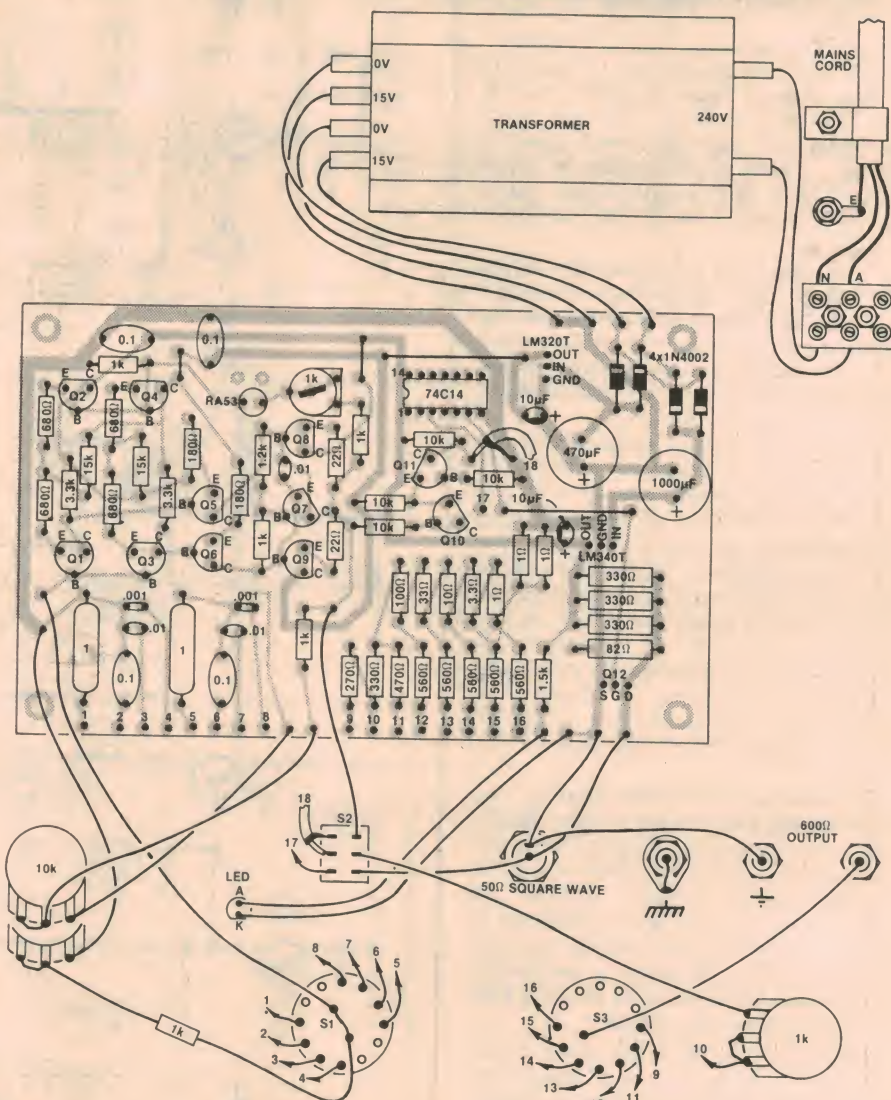
The advantage of VMOS over bipolar is that FETs are majority-carrier devices, hence minority-carrier lifetimes do not slow switching speed as with bipolars. In fact, the only thing slowing a VMOS circuit down is the impedance of the gate drive circuit which must be low to counteract "Miller effect", ie, the fast changing drain voltage being fed back to the gate via  $C_{gd}$ , the capacitance between drain and gate. The CMOS Schmitt triggers provide a reasonably low input impedance and have enabled us to obtain rise and fall times of less than 20ns.

The drain load of Q12 consists of three 330 $\Omega$  and one 82 $\Omega$  resistor. These values were selected so as to give a 6V peak-to-peak square wave output, which is equivalent to 3V RMS; hence when you switch from sine to square wave the output signal level doesn't change. This square wave output goes directly to a 50 $\Omega$  BNC output socket or via switch S2b to the 600 $\Omega$  output.

Variable attenuation of either the sine or square wave is accomplished by a 1k $\Omega$  potentiometer and the resistor ladder comprising the stepped attenuator. The resistance of the stepped attenuator is about 480 $\Omega$  which gives about 10dB variation in output level via the 1k $\Omega$  potentiometer. The resistors in the stepped attenuator have been selected to give 10dB attenuation steps and resistors in series with each attenuator output provide a nominal 600 $\Omega$  output impedance.

The various steps on the attenuator are selected via switch S3, a single-pole seven-position switch which provides 3V maximum output and 3mV RMS minimum. Using the 1k $\Omega$  level control the output can be further reduced to 1mV RMS.

Power for the circuit is derived from two three-terminal regulators, an LM340T-15 which is a 15V positive regulator, and an LM320T-15 negative 15V regulator. Together, these supply  $\pm 15\text{V}$  with good regulation and very low ripple and noise. Input to the regulators is from a bridge rectifier and capacitor filter driven by a 30V centre-tapped transformer.



Follow this diagram when wiring up the oscillator and keep all mains wiring neat and tidy. A small aluminium heatsink should be fitted to the LM340T15.

In applications such as low distortion audio oscillators and amplifiers, transformer hums fields have to be kept to an absolute minimum. We at first tried a standard 30V transformer in the power supply but found this radiated quite a strong hum field regardless of its orientation. Next, we used a Ferguson PL 30/40 low profile transformer which proved to have a very low hum field – a fact we would attribute to the metal strap around the transformer which acts in the same way as a copper shorting strap in cutting down flux leakage.

## Construction

We mounted most of the components on a single PC board coded 81ao6 and measuring  $145 \times 91$  mm. Mount the components on the PC board according to the component overlay shown elsewhere in this article and pay particular attention to the orientation of

the transistors, diodes and electrolytics. Note that the VMOS transistor and the CMOS IC can be damaged by static electricity so take the usual precautions.

We housed our audio oscillator in a Musicolour chassis (available from most kit retailers), though any metal case of similar dimensions would be appropriate. Drill mounting holes for the transformer, PC board etc, using internal photographs of our unit as a guide, and make sure that when the unit is fully assembled the PC board does not interfere with the front panel controls.



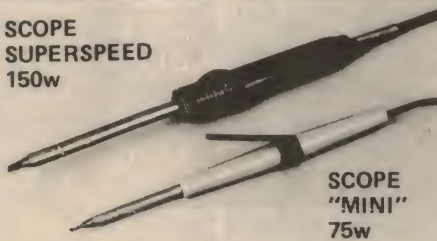
No power switch is provided on this unit as mains wiring has to be kept well away from the front panel, though one could be fitted to the rear of the unit if desired. The mains cable should enter on the rear of the chassis close to the transformer, passing through a grommetted hole, and be securely



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<ul style="list-style-type: none"> <li>● No power</li> <li>● No time to get power</li> <li>● Must work on live gear</li> </ul>	<p>SCOPE "CORDLESS"</p> 	<ol style="list-style-type: none"> <li>1. 40–200 Terminations depending on conductor size.</li> <li>2. Recharges overnight.</li> <li>3. Heats in 6 seconds.</li> <li>4. 60 watts — Controllable temperature.</li> </ol>
<ul style="list-style-type: none"> <li>● 12 volt. Battery power available only.</li> <li>● Outdoor and bad weather expected.</li> <li>● Service vehicle can get within 6 metres.</li> </ul>	 <p>SCOPE "12VOLT SUPERSPEED"</p>	<ol style="list-style-type: none"> <li>1. 5 Second heating.</li> <li>2. 200 watts if needed.</li> <li>3. Controllable temperature.</li> <li>4. You can replace tip or element anywhere in minutes.</li> </ol>
<ul style="list-style-type: none"> <li>● Modern sophisticated PCB equipment.</li> <li>● Accurate &amp; automatic temp. control wanted.</li> <li>● Components are heat critical.</li> </ul>	<p>SCOPE "TC60"</p> 	<ol style="list-style-type: none"> <li>1. Heats in 45 seconds.</li> <li>2. Dial any temp. 200°–400°.</li> <li>3. Plugs direct to mains. No transformer needed.</li> <li>4. Accept iron plated tips from 0.8mm to 6.4mm.</li> </ol>
<ul style="list-style-type: none"> <li>● Unpredictable soldering situation.</li> <li>● Maybe electrical or electronic or mechanical.</li> <li>● You can't come back to base for a bigger or smaller iron.</li> </ul>	<p>SCOPE SUPERSPEED 150w</p>  <p>SCOPE "MINI" 75w</p>	<ol style="list-style-type: none"> <li>1. 5 second heat up.</li> <li>2. Controllable temperature.</li> <li>3. Reserve heat for any normal job.</li> <li>4. 4 volt safety in the hand.</li> </ol>

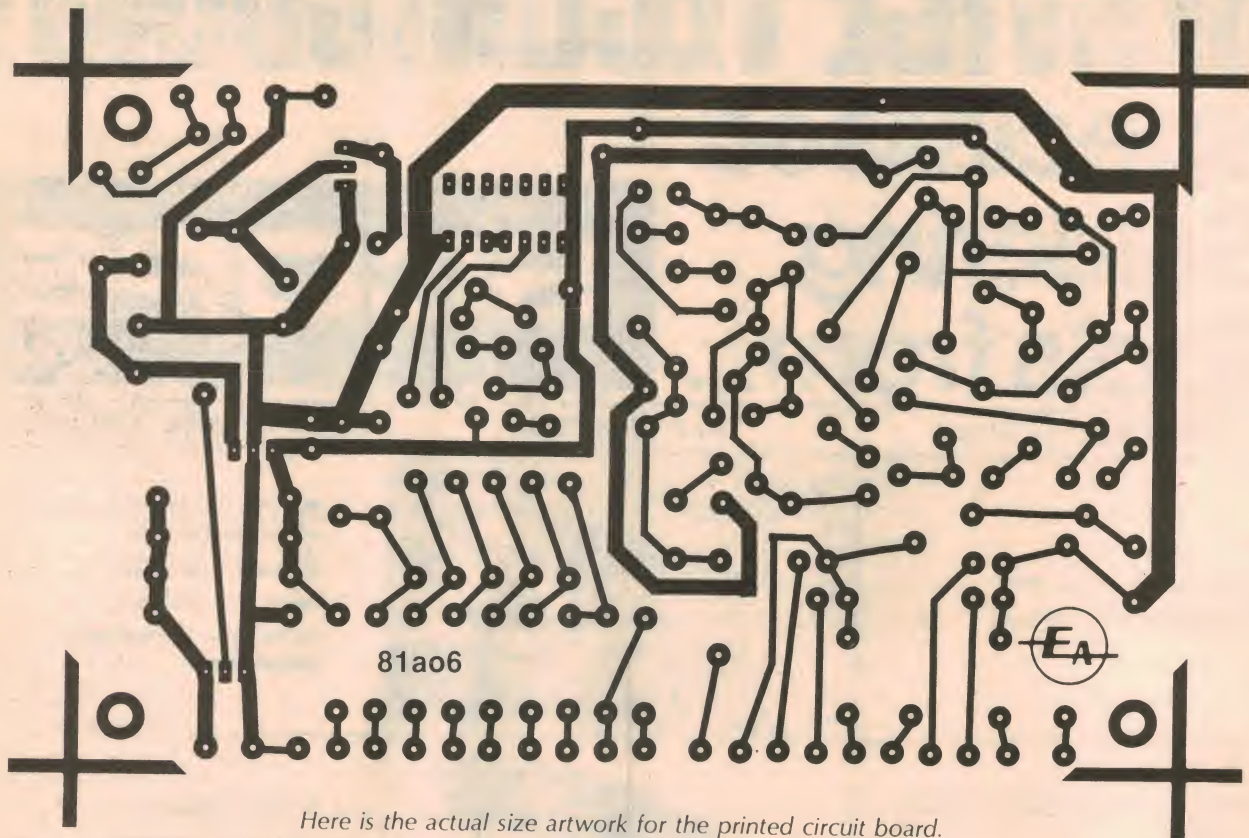
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Here is the actual size artwork for the printed circuit board.

clamped and terminated in a 3-way terminal block. The earth lead should be soldered directly to a lug which is securely bolted to the chassis.

To avoid possible earth loops we have left the oscillator outputs floating with respect to chassis and mains earth and

provided a separate chassis earth connection on the front panel next to the 600 $\Omega$  outputs.

To ensure the outputs are floating we have specified an insulated BNC socket for the 50 $\Omega$  square wave output.

The front panel can be made up from a

sheet of 18G aluminium 90  $\times$  275mm. Finished Scotchcal aluminium labels for the front panel and dial are available from Radio Despatch Service, 869 George St, Sydney or Rod Irving Electronics, 425 High St, Northcote, Victoria. We have not included actual-size front panel artwork with the article because it is too big to fit on the page.

The dial was calibrated using a 10k $\Omega$  linear pot which explains why the markings are crowded at one end (ideally we would have used an "inverse law" potentiometer but these are not readily available). Affix the Scotchcal label for this dial to, say, a 20-gauge piece of aluminium, which can then be cut to the correct shape and glued to a suitable knob, ie one which matches the other control knobs.

### Setting up

Wire up the board and front panel controls according to the wiring diagram keeping leads as short as possible. Make another check of the board and wiring then, switch on and check the +15 and -15V supplies. Next check that the quiescent current is about 5mA or slightly more. This can be accomplished by measuring the voltage across the 2  $\times$  22 $\Omega$  resistors (should be 220mV) or inserting a milliammeter in place of the link from the collector of Q8 to +15V.

If the quiescent current through Q8 and Q9 is less than 5mA, increase the

## PARTS LIST

- 1 metal case (see text)
  - 1 PC board coded 81a06, measuring 145  $\times$  91mm
  - 1 mains transformer Ferguson PL 30/40
  - 1 single-pole, seven-position rotary switch
  - 1 DPDT miniature toggle switch
  - 1 2-pole (or 3-pole) 4-position rotary switch
  - 4 Richco CBS-6N PCB supports
  - 1 dual ganged 10k $\Omega$  linear potentiometer
  - 3 terminal posts and banana sockets, green, red, black
  - 1 insulated BNC socket
  - 1 mains cord and plug
  - 1 mains cord clamp and grommet
  - 1 1k $\Omega$  (lin) potentiometer
  - 1 1k $\Omega$  miniature horizontal trimpot
- SEMICONDUCTORS**
- 1 74C14 CMOS hex Schmitt trigger
  - 1 LM340T-15 positive regulator
  - 1 LM320T-15 negative regulator

- 1 VN88AF VMOS transistor
- 7 BC549 NPN transistors
- 4 PN4250 PNP transistors
- 4 1N4002 diodes
- 1 small red LED
- 1 RA53 thermistor (made by ITT)

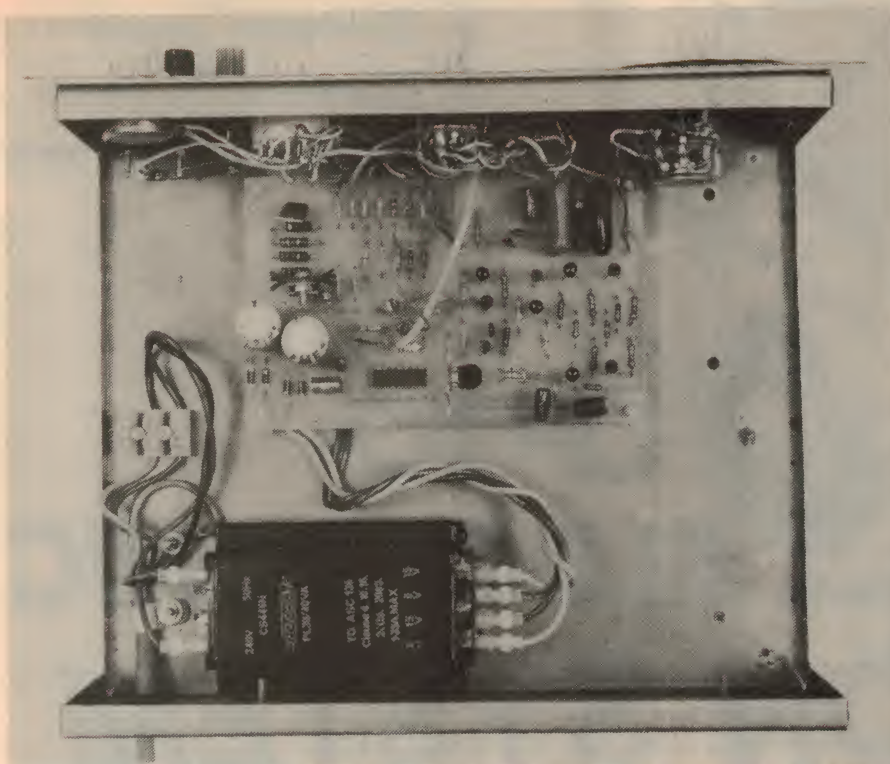
### CAPACITORS

- 1 1000 $\mu$ F/25VW PC electrolytic
- 1 470 $\mu$ F/25VW PC electrolytic
- 2 10 $\mu$ F/25VW tantalum
- 2 1 $\mu$ F greencap (metallised polyester)
- 4 0.1 $\mu$ F greencap
- 3 0.01 $\mu$ F greencap
- 2 .001 $\mu$ F greencap

### RESISTORS (all 1/4W 5%):

- 2  $\times$  15k $\Omega$ , 4  $\times$  10k $\Omega$ , 2  $\times$  3.3k $\Omega$ , 1  $\times$  1.5k $\Omega$ , 1  $\times$  1.2k $\Omega$ , 5  $\times$  1k $\Omega$ , 4  $\times$  680 $\Omega$ , 5  $\times$  560 $\Omega$ , 1  $\times$  470 $\Omega$ , 1  $\times$  330 $\Omega$ , 1  $\times$  270 $\Omega$ , 2  $\times$  180 $\Omega$ , 1  $\times$  100 $\Omega$ , 1  $\times$  33 $\Omega$ , 2  $\times$  22 $\Omega$ , 1  $\times$  10 $\Omega$ , 1  $\times$  3.3 $\Omega$ , 3  $\times$  1 $\Omega$
- 1W RESISTORS: 3  $\times$  330 $\Omega$ , 1  $\times$  82 $\Omega$





The PCB is mounted in the chassis using Richco plastic standoffs.

1.2k $\Omega$  resistor connected to the base of Q7 to say 1.5k $\Omega$  or greater. Similarly if it's more than 5mA, reduce the 1.2k $\Omega$  resistor.

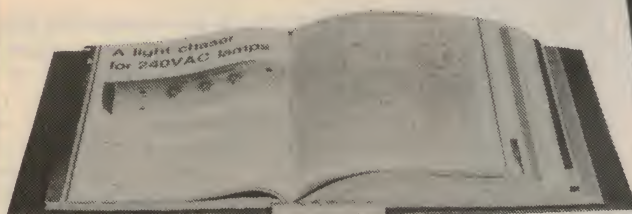
Now set the attenuator to 3V RMS and adjust the output level control to maximum. Connect a multimeter to the output with the unit switched to sinewave output and adjust the 1k $\Omega$  trimpot for a 3V output at 1kHz. ②

We estimate that the current cost of parts for this project is approximately

**\$70**

including sales tax.

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The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: \$5.10 binders, \$4.50 holders.

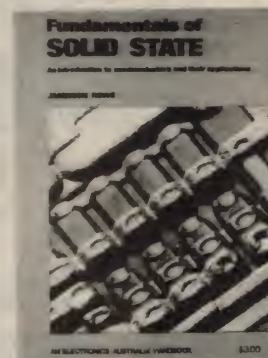
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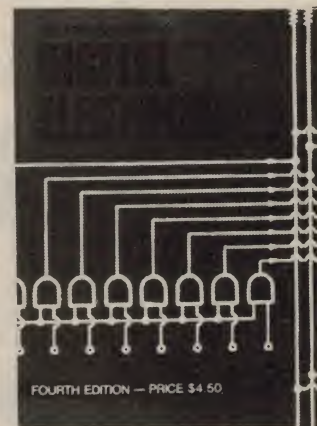
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- ★ Eliminates points
- ★ Maintenance free
- ★ Locks in engine tune

# Build your own **OPTO-ELECTRONIC IGNITION SYSTEM**

The conventional automotive contact breaker is still widely used in modern petrol engines despite its shortcomings. This opto-electronic design is simple, maintenance-free and will drive almost any electronic ignition system that operates with mechanical contacts.

by J. R. WATKINSON, B.Sc., M.Sc.

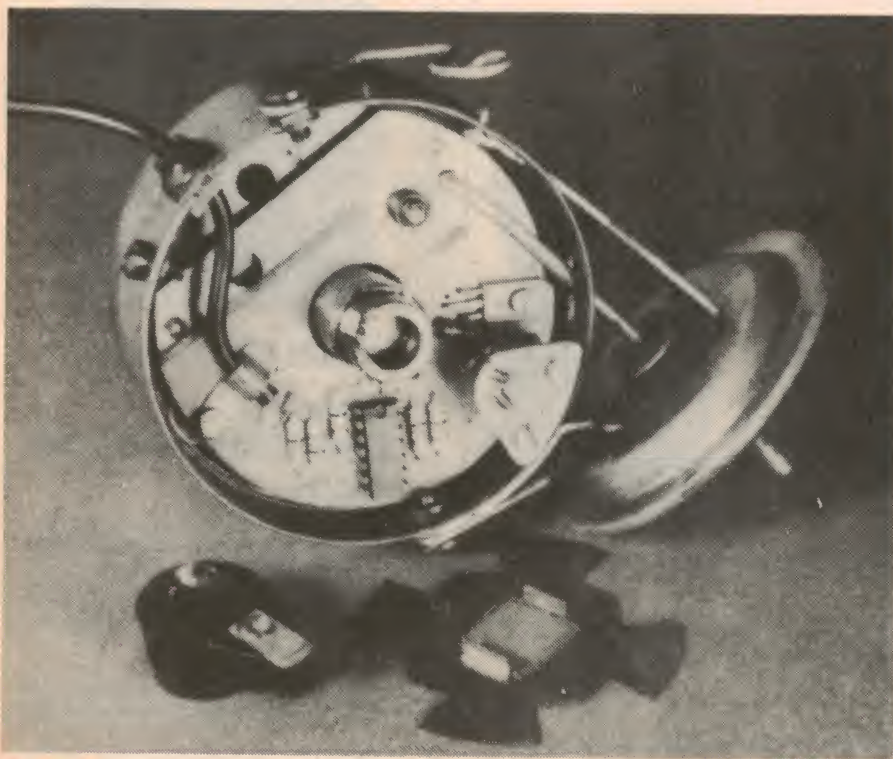


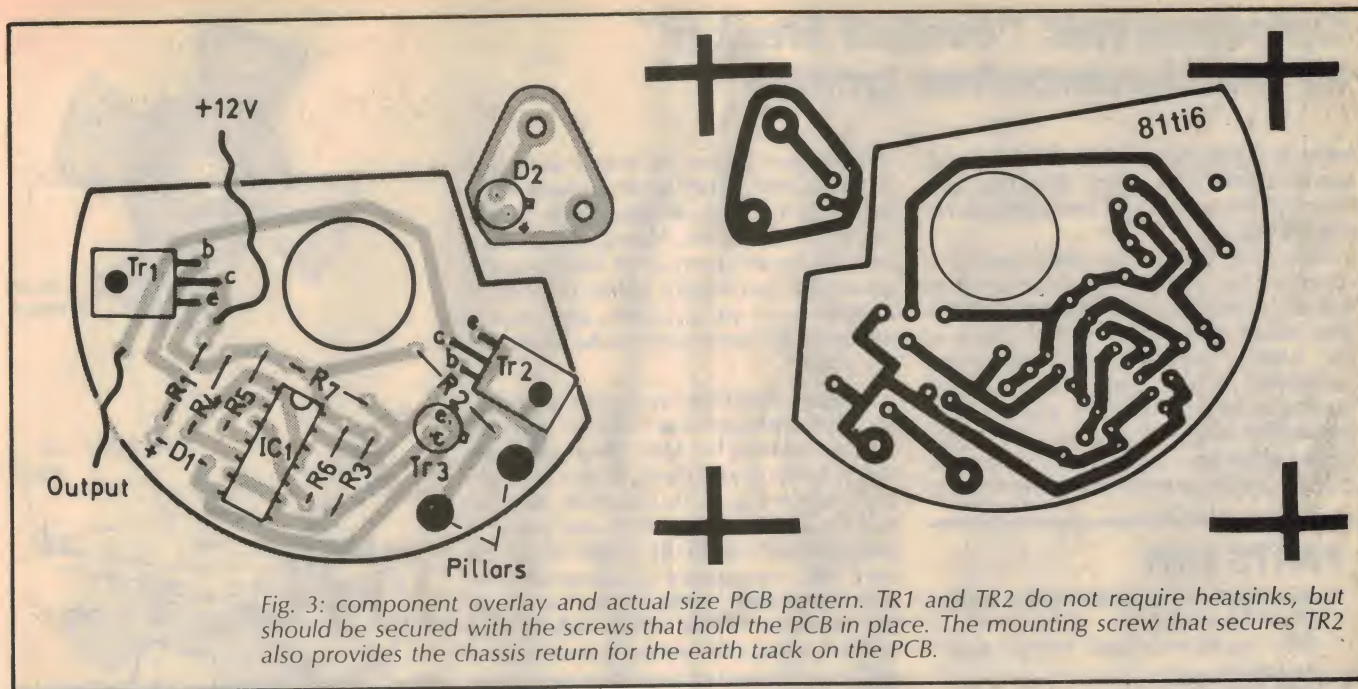
Fig. 2: the assembled printed circuit board, mounted on the action plate of a distributor. In the prototype TR1 was mounted underneath the board.

Although many electronic ignition units are available, and several well designed constructional circuits have appeared, most of them are triggered by the existing contacts and use either inductive or capacitive discharge to improve the spark and extend contact life. Some designs claim to eliminate the effect of contact bounce, but the effects of contact heel wear and timing scatter still remain.

The circuit in Fig. 1 provides an output which, for low currents, simulates the contact breaker and can trigger an electronic ignition unit without modification. The existing centrifugal and vacuum advance mechanisms are retained, and the only mechanical part which must be constructed with any precision is a chopper disc.

The light source is an infrared LED with a lens to give a well defined beam, which is received by a spectrally and physically matched phototransistor. Light passing between the two devices is interrupted by a chopper disc which produces a rough square wave. This waveform is cleaned up before it is used for timing because electronic ignition circuits often require a sharp edge to trigger an SCR. A conventional two transistor Schmitt-trigger was not used because the regenerative action only occurs if the input has a low source impedance and, in this design, the phototransistor is a current source. Instead, an open collector TTL IC with two gates connected as a set-reset bistable is used. The inputs are driven in a complementary mode by using a third gate as an inverter, and the remaining gate is used as a buffer. The regenerative action





of this circuit gives fast switching, and a conservatively rated series regulator provides reliable operation.

The complete circuit can be built on a glassfibre PCB and mounted inside the distributor as shown in Fig. 2. The prototype fits a Delco distributor as fitted to many GM vehicles, but the layout can be modified to fit most other types. Some foreign vehicles use very small distributors, and for these it is best to house the circuit in a small metal box beside the distributor. Installation is much easier if a replacement distributor is used. Also, the second unit is useful to carry as a spare.

The phototransistor is mounted directly on the PCB and the LED is mounted about 2.5mm away on a small board supported by 3mm tapped pillars which also carry the LED current. The main PCB is mounted with spacers on the action plate in the distributor with 3mm screws which must have holes drilled and tapped. As the action plate is rotated by the vacuum advance mechanism, it must not be obstructed by the board or swarf, and the manufacturer's recommended lubricant should be restored. If the existing contact pivots on a pillar rivetted to the action plate, the pillar must be removed before the PCB can be installed.

Care must be taken to ensure that the small board does not foul the rotor arm or the inside of the distributor cap. When installed, the PCB is connected to the ignition unit by a length of good quality miniature three core stranded cable. The third wire is either left unused, or used to provide an additional earth path to the TAI unit. The cable should be supported by a small P clip fixed by one of the mounting screws, and by the existing grommet in the distributor body. Remember to leave enough cable loose so that the action plate can revolve.

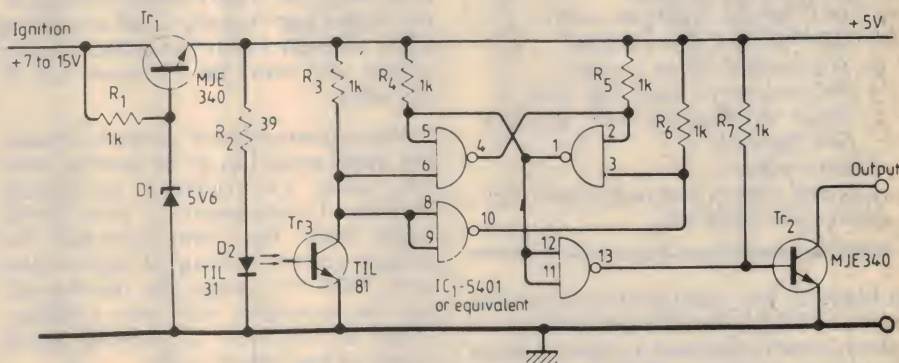


Fig. 1: trigger circuit and regulator. Readers are advised to fit a 100 $\mu$ F 16VW electrolytic capacitor across the zener diode (— Ed).

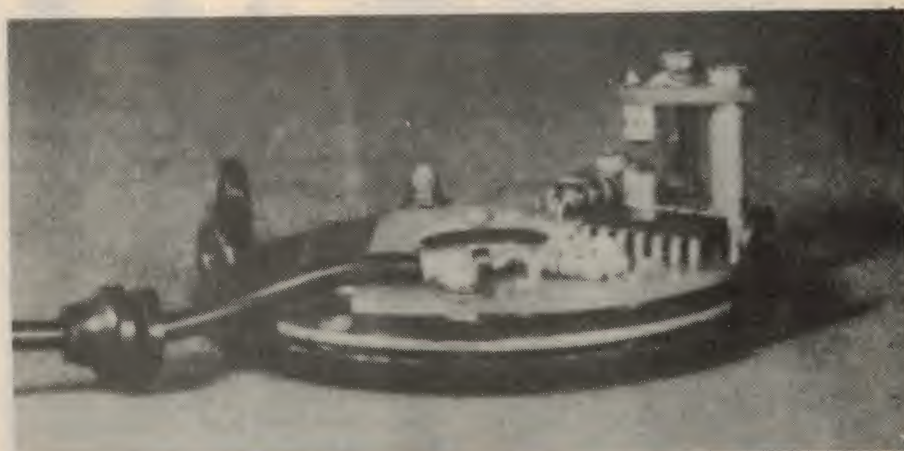


Fig. 4: phototransistor and LED mounting details. The two pillars must be metal types to carry the LED current.

The circuit can be tested by connecting +12V to the supply lead, and a low power bulb from +12V to the output lead. The lamp should remain on until the light beam is interrupted. Note that the specified device does not emit visi-

ble light. If the circuit switches the lamp correctly, connect it to the electronic ignition unit and take the high tension (HT) lead from the coil directly to one spark plug. This will avoid coil breakdown if the rotor arm is not pointing at a seg-



# Optoelectronic "contact breaker" for maintenance-free ignition

ment of the distributor cap. Check that a spark is generated every time the light beam is interrupted and not when it is re-established.

When the circuit has been tested, a chopper disc should be constructed to suit the distributor. The accuracy of this disc affects the overall performance of the system, and the most important parameter is the angle between the leading edge of the blade and the line joining the mainshaft axis with the centre of the rotor arm sector. It is imperative that this angle causes the leading edge of

the chopper blades are evenly spaced to avoid scatter. The angle between the blades is found by dividing  $360^\circ$  by the number of cylinders. Although this unit is suitable for any number of cylinders, the greatest improvement will be noticed on engines with six cylinders and above, where multi-lobed cams cause more timing scatter.

The disc does not need great strength, and the prototype was cut from tinplate. The centre hole has tabs which are alternately bent up and down to grip the cam as shown in Fig. 5. To construct the disc make a centre punch mark and scribe a straight line through the centre mark. Using a large transparent circular protractor with 0 and  $180^\circ$  marks on the line, mark the position of the blade edges and scribe lines to the centre. If an inductive discharge system is used (ie a transistor-assisted ignition system without dwell extension), the angle between the chopper blades becomes the dwell angle, the angle through which the points remain closed, and must be the same for all cylinders.

With a conventional contact breaker the dwell angle has to be short so that the points can open a reasonable distance. Unfortunately, a short dwell angle limits the time available for primary current build-up at high revolutions. With this design, the dwell angle can be increased from the manufacturer's specification to increase spark energy at high revolutions.

However, if the unit is used with a capacitor discharge ignition system, the angle between the blades is not impor-

tant because the spark is controlled only by the leading edges of the chopper blades. This also applies to transistor-assisted systems with in-built dwell extension (see EA December, 1979).

Cutting the disc shape is made easier if the tinplate is clamped to a thin sheet of aluminium or plywood. After drilling the centre hole and filing it to shape, cut the disc to the correct diameter, cut the blades to shape and finish with a fine file. Finally, bend the tabs for a good central fit on the cam.

The disc is then fixed to the cam with epoxy resin after checking that all the parameters are correct and that the disc revolves freely. When installation is complete, the distributor can be mounted in the engine and adjusted for correct timing with a strobe light.

Although this unit will not produce a dramatic increase in performance from a correctly tuned engine, the firing at high revolutions should be smoother and tickover should be very steady even when cold, which permits sparing use of the choke. However, the main benefit is a maintenance-free ignition system. The prototype has now been in use for five years and the distributor cap is only removed to show disbelievers.

## PARTS LIST

- 1 printed circuit board set, code 81ti6, 74 x 58mm
- 1 5401 quad two-input NAND gate (see text)
- 2 MJE340 NPN transistors
- 1 TIL81 phototransistor
- 1 TIL31 infrared LED (see text)
- 1 5.6V 400mW zener diode
- 6 1k $\Omega$  resistors ( $\frac{1}{4}$  or  $\frac{1}{2}$  watt)
- 1 39 $\Omega$  resistor ( $\frac{1}{2}$  watt) (see text)
- 1 100 $\mu$ F 16VW electrolytic capacitor (see caption)
- 2 brass pillars
- Machine screws and nuts, cable clip, three-core cable etc.

a blade to just obscure the LED, ie the point of firing, when the end of the rotor arm is directly opposite a segment inside the distributor cap, with the vacuum advance at mid-travel. If this condition is not achieved the engine may not run.

Another important requirement is that

## Special comments . . .

Following publication of the Transistor-Assisted Ignition system in December 1979, many readers asked us to describe a matching trigger unit to eliminate the conventional contact breaker. The above project is reprinted from "Wireless World" and is compatible with both the "Electronics Australia" TAI system and the CDI system described in July 1975.

Because we have not built and tested the project, however, we are NOT able to offer advice to readers who encounter difficulties (either electronic or mechanical). For this reason, we do NOT recommend that readers tackle this project unless they know exactly what they are doing, particularly in regard to installation and engine tuning.

Most of the parts, including the PCB, should be available through your usual supplier. The 5401 quad two-

input NAND gate is being specially imported and will be available towards the end of June from Radio Despatch Service, 869 George St, Sydney 2000. Do not use the 7401 device — its temperature rating is not high enough.

Radio Despatch Service also stocks the TIL81 phototransistor, but the TIL31 infrared LED is not available. The Philips CQY89A device should be suitable however, although it may have to be fitted with a small light tube to prevent false triggering due to light scatter (unlike the TIL31, the CQY89A is not lensed). Note that R2 should be increased to 68 $\Omega$  for the CQY89A.

Finally, make sure that you do the job in a workmanlike manner. If a breakdown occurs it will no longer be possible to revert quickly to the old ignition system.

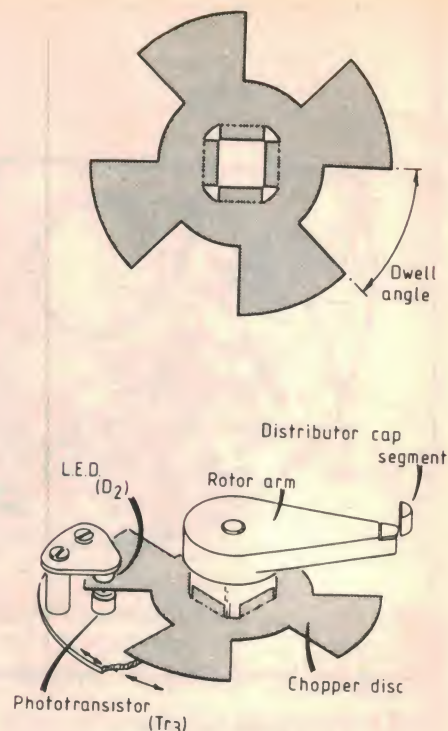


Fig. 5: typical shape and mounting for the chopper disc. It is imperative that, when the disc just interrupts the light beam, the rotor arm is directly opposite a distributor segment with the vacuum pushrod at mid travel.



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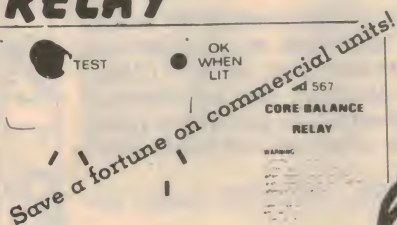
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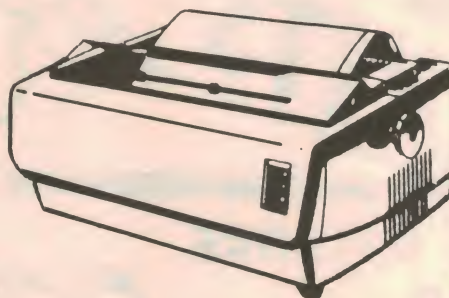
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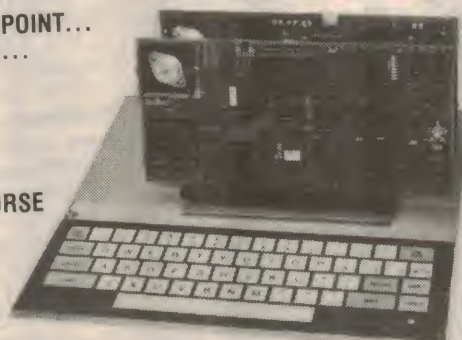
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## **SPECIFICATIONS:**

<b>CPU</b>	Z80 2MHZ (4MHZ Option)
<b>I/O</b>	8 BIT INPUT PORT, 2 Programmable I/O PORTS 4 Channel Counter/Timer all interrupt driven On board provision for cassette and printer interface
<b>VDU</b>	64 characters/line, 16 lines/screen, 128 upper/lower case characters with graphics.
<b>MEMORY</b>	On board 2K ROM/2K RAM expandable to 64K with low cost/reliable STATIC S100 Ram boards.
<b>KEYBOARD</b>	Full ASCII (upper/lower case) with audible tactile feedback... preassembled/tested.
<b>EXPANSION</b>	S100 bus. Motherboard has 4 slots, options to 10 slots.

## **BUILD IT YOURSELF & SAVE A BUNDLE!**

By adding optional S100 cards you can build a system to match virtually any "ready made" such as TRS80, SYSTEM 80, SORCERER, APPLE or PET at a fraction of the cost!!! The INSTRUCTOR 80 is also available Assembled/tested for \$449.00.

## **BEWARE OF CHEAP IMITATIONS**

Instructor 80 uses the Z80 at full speed (2MHz). VDU produces 64 characters/line UPPER/LOWER CASE and GRAPHICS. INSTRUCTOR 80 uses only proven STATIC MEMORY-expandable to 64K. Full software support including BASIC, ASSEMBLER and GAMES now available.

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A large, efficient loudspeaker system with 100W capacity!

# Peerless PAS100 3-way 100-litre loudspeaker

This loudspeaker system is the first of three systems to be presented using Peerless drivers. The first, the Peerless PAS100, is a large three-way system with high efficiency and generous power handling for those with large rooms, and plenty of amplifier power. The Peerless PAS100 provides a frequency response from below 40Hz to beyond the upper limits of audibility.

by LEO SIMPSON

The Peerless PAS100 loudspeaker system presented here is the most powerful loudspeaker system for high fidelity use that we have ever featured. With an internal capacity of 100 litres, a power handling capacity of 100 watts plus sensitivity of 93.5dB, it is a very good solution to those people who require a large loudspeaker system which can handle the power output of today's powerful amplifiers and receivers.

To accommodate a pair of these loudspeakers, a large listening room is almost mandatory. This is firstly necessary to provide the required floor space since, not only do they require the actual space that they stand upon but, for best results, they require a certain amount of free space around them. They should not be placed close to the corners of the room and ideally should be at least 30cm from the nearest wall.

The second and ultimately more important reason for having a large listening room is to allow the system to produce the low frequency bass reproduction of which it is capable. The laws of physics inhibit the reproduction of low bass frequencies in small rooms so do not consider the Peerless PAS100 if your living room is only four metres square.

On the other hand, if you are able to perform elementary carpentry and can solder, you could obtain a great deal of satisfaction from building these loudspeakers. They are supplied with ready-cut veneered cabinets which assemble together very easily to produce a finish which is comparable with quality loudspeaker systems sold by high fidelity retailers.

In this respect, a kit-built loudspeaker system offers a unique opportunity to the do-it-yourself enthusiast and electronics beginner. Even if he decides he is not up to the challenge of constructing a complete amplifier, AM/FM tuner or other electronic hifi component, he can still successfully complete assembly of this loudspeaker system.

Again, even the skilled electronics hobbyist may decide that he has not the time to build his own gear or perhaps may desire a particular combination of commercial equipment. With this combination he can team a pair of the Peerless PAS100 systems for a very small amount of time and effort.

One other point before we proceed to describing the drivers and cabinet: You don't have to buy the complete kit. If you are skilled in cabinet making and

and manufactured in Denmark and are distributed in Australia by G.R.D. Group Pty Ltd, of Camberwell, Victoria. It was G.R.D. Group who approached us and suggested that we feature a number of articles on Peerless designs, as a suitable follow-up to our highly successful and very popular Playmaster designs, the most popular being the Playmaster 3-75L featured in May 1977.

Having reviewed the three loudspeaker systems submitted by G.R.D. Group we had to admit that they were eminently suitable. Although notably more expensive than the earlier Playmaster systems they are attractive in that they represent a way for the kit builder to obtain an outstanding loudspeaker system for less than he would pay for a comparable finished system from a hifi retailer.

Do these Peerless designs supersede our earlier Playmaster designs? More



Two views of the Peerless PAS100 system, with grille cloth and without.

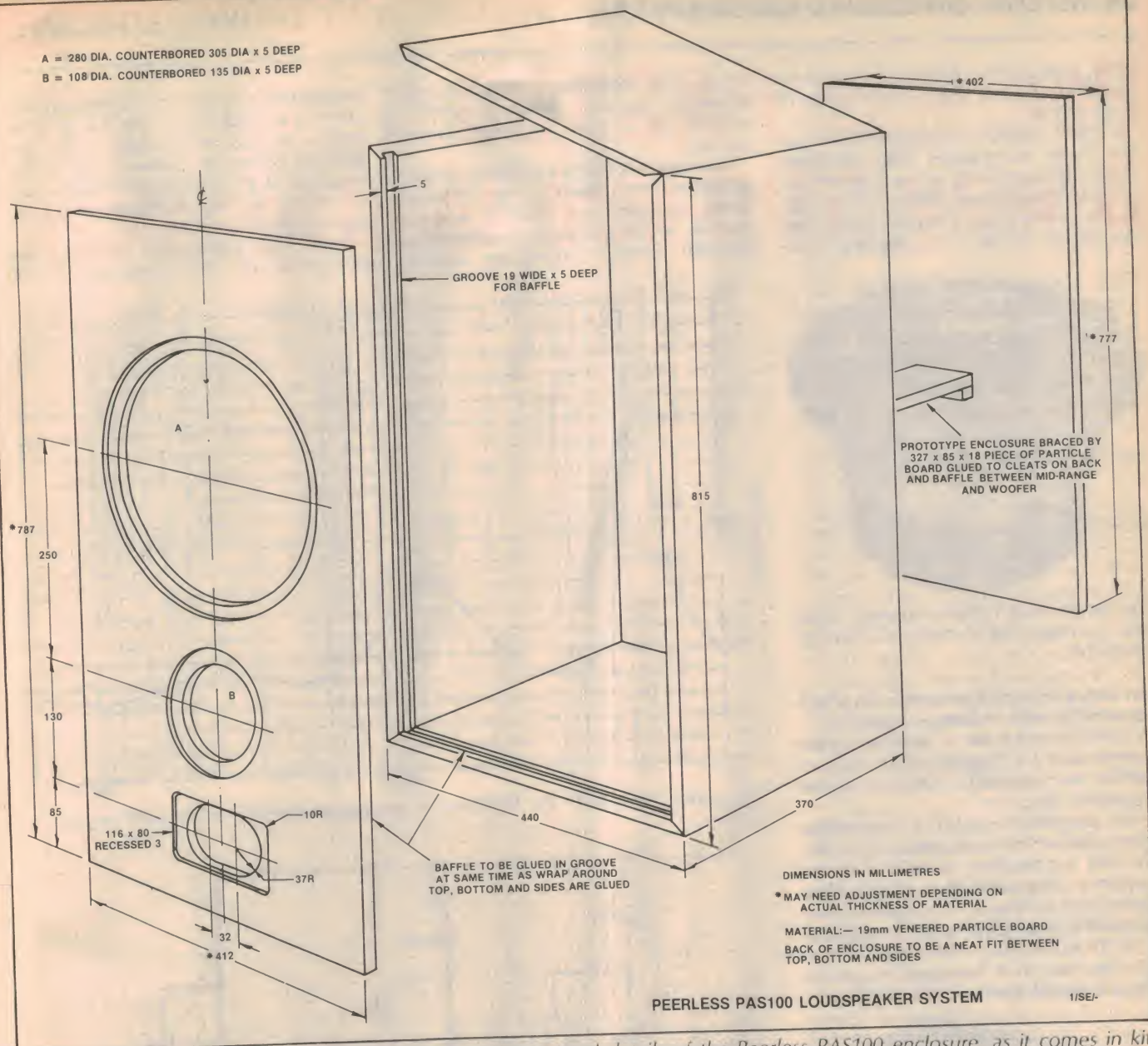
have the requisite tools or want to make a cabinet to suit a particular decor, then you can work to the cabinet dimensions provided with this article and possibly save yourself a nice little sum in to the bargain.

Peerless loudspeakers are designed

specifically, does the Peerless PAS100 supersede the popular Playmaster 3.75L design? Well no, in that where the Playmaster designs are still currently available, they offer exceptional value for money. The extra money spent on the Peerless designs buys more efficien-



A = 280 DIA. COUNTERBORED 305 DIA x 5 DEEP  
B = 108 DIA. COUNTERBORED 135 DIA x 5 DEEP



PEERLESS PAS100 LOUDSPEAKER SYSTEM

1/SE-

cy, more power and ultimately, a better quality loudspeaker system, although the audible differences may not seem commensurate with the price to those to whom the extra dollars are important.

Easily the most impressive single component of the Peerless PAS100 system is the woofer, KD120WFX. This has a nominal diameter of 305mm (that is 12 inches in obsolete parlance) with a large foam rubber roll surround which enables the low resonance figure of 26Hz to be achieved in free air. A large ceramic magnet provides a high flux density of 1.18 Tesla (11800 Gauss). This results in a Q-factor of 0.4 and sensitivity of 93.5dB. Explaining this last parameter, this means that the woofer will produce a sound pressure level of 93.5dB at a distance of one metre on its axis with a drive signal of one watt, at a particular reference frequency (which is probably 400Hz in this case).

The foam rubber roll surround is of

Here are dimensional details of the Peerless PAS100 enclosure, as it comes in kit form, ready for "wrap-around" assembly. Note that it is drawn in the upside-down position in which it should be put together. A handyman carpenter building an enclosure from uncut sheets should work to the external dimensions, using internal cleats as necessary. The baffle and back panel dimensions would need to be modified to become a slide-in fit.

"closed cell" construction and is treated on the rearside with damping material to control resonances in the surround itself.

The cone material is Peercone (a registered trade name of Peerless), a white moulded polypropylene which is said to have high tensile strength, low mass, high temperature stability and high internal damping. In short, it is a material which would appear to be ideal for loudspeaker cones, being strong and light. In fact, the total moving mass of the woofer is only 42 grams.

When mounted in the enclosures, the woofer resonance rises to only 45Hz, a very creditable figure. This can be noted from the curve showing the impedance

(modulus) variation over the audio range. This means that the woofer can deliver usable bass response down to around 30Hz.

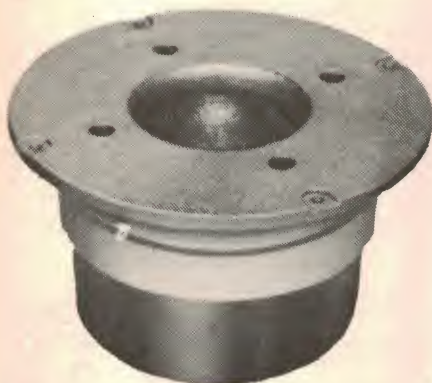
The upper frequency limit of the Peerless woofer is 1500Hz but the crossover point to the midrange driver is well below that at 500Hz. The midrange driver is the Peerless KA20DMR which has a soft dome with a nominal diameter of 50mm. Fundamental resonance is 270Hz and working range of the driver is 600Hz to 6kHz with a smooth rolloff at both extremes. This enables the use of a relatively simple crossover network.

Rated power of the midrange is again 100 watts, to match the woofer. This



rating applies for a crossover frequency of 600Hz or more with a rolloff slope of 12dB/octave.

A feature of the midrange driver is that the dome is recessed into the front mounting plate which gives it some protection against the possibility of damage. At the same time, Peerless claim that placing the dome in a cylindrical aper-



The Peerless KA20DMR midrange driver has a 50mm dome recessed into the faceplate.

ture forms a type of acoustic lens which presumably aids midrange dispersion.

Crossover from the midrange to the tweeter is at 4kHz, again with a slope of 12dB/octave applied to both the tweeter and midrange.

The tweeter is again a dome-type driver with a nominal diameter of 50mm. This has a resonance of 1000Hz and a frequency range of 1500 to 20kHz. Maximum input power is 10 watts RMS but provided it is used with a 4kHz crossover at 12dB/octave (as is the case here) it may be used in a loudspeaker system with a nominal rating of 100 watts.



The Peerless K010DT tweeter has a 25mm dome and covers the range from 4kHz to 20kHz.

As may be expected from a small dome tweeter such as this, the high frequency dispersion is very good, as depicted on the accompanying graph of sound pressure response. Characteristic sensitivity of the tweeter is 92dB.

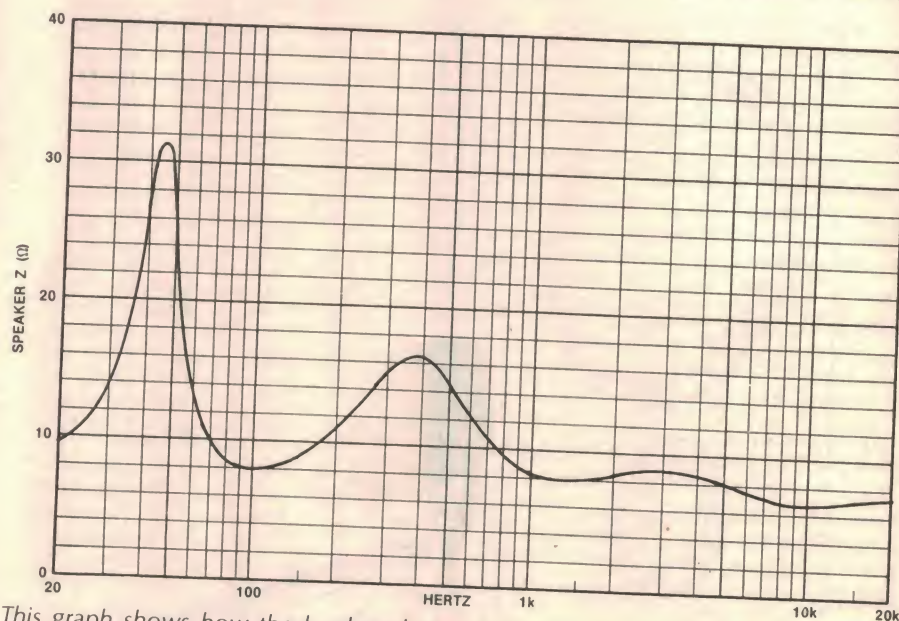
All of the crossover components are mounted on a PC board which uses push-on connectors for all terminations to the three drivers. The crossover capacitors are non-polarised electrolytics while the inductors are air-

cored. The exception to this is the five millihenry woofer inductor which is wound on a soft magnetic (ferrite?) former.

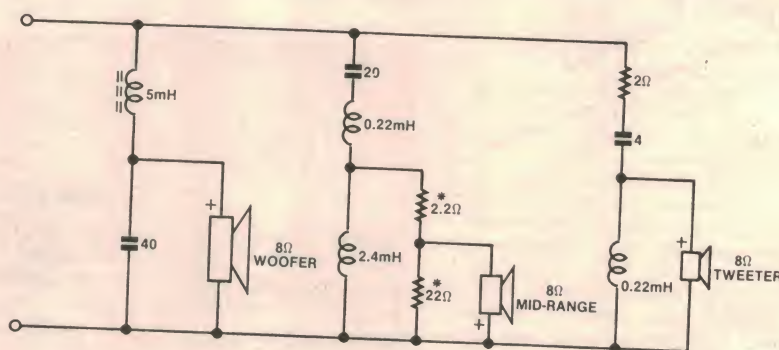
Two resistors in the crossover network are not actually on the PC board. These resistors are marked with an asterisk on the circuit and comprise an optional constant impedance network

impedance is very slight. The impedance curve is a good one in that it is at 8Ω or above for most of the audio range and dips just below 7Ω at around 10kHz. This means that the Peerless PAS100 should cause no loading problems at all for typical stereo amplifiers.

Well that completes the technical discussion of the Peerless PAS100



This graph shows how the loudspeaker system impedance varies with respect to frequency.



This is the complete circuit of the Peerless PAS100 showing drivers and crossover network.

that we added to reduce the signal to the midrange driver by 3dB. We felt that this was desirable to reduce the "presence" of the system caused by the midrange tending to dominate the tweeter.

Those constructors who wish to add this midrange attenuator network may do so readily by wiring the 22Ω and 2.2Ω resistors across the terminals on the back of the midrange driver. The resistors should have a rating of at least 1W.

The graph of the impedance modulus versus frequency was taken with the midrange driver attenuator network in circuit, although its effect on the overall

system. Let us now talk about construction. As already mentioned the cabinet is large, with specified dimensions of 440 x 815 x 370mm, not including the grille cloth frame. Mass is approximately 25kg.

You may buy the kit in two forms. The first includes, the speakers, crossover PCBs, interconnecting wires and rear terminal panels for a stereo pair but without the cabinet materials. The second form includes all of the above plus cabinet kits, acoustic filling material, foam sealing tape and all other materials to complete the enclosures, with perhaps the exception of the adhesive.

If you have the tools to make the



# Facts from Fluke on low-cost digital multimeters

When you're looking for genuine value in a low-cost DMM you have a lot more to consider than price. You need information about ruggedness, reliability and ease of operation. Accuracy is important. And so are special measurement capabilities. But above all, you must consider the source, and that company's reputation for service and support.

## The economics of endurance.

Even the least expensive DMM isn't disposable. Accidents happen, and test instruments should be built to take the abuses of life as we live it.

Look for a DMM with a low parts count for reliability, and rugged internal construction protected by a high-impact shell.

Another feature to check out is protection against overloading, whether from unexpected inputs, transients, or human errors.

Just for the record, all Fluke low-cost DMM's meet or exceed military specs, and feature extensive overload protection.

## The importance of being honest.

Just because a multimeter is digital doesn't mean it's automatically more accurate than a VOM — even though the LCD might give you that impression. The benchmark for accuracy in DMM's is *basic dc accuracy*. The specs will list it as a percentage of the reading for various dc voltage ranges.

Of course accuracy is more critical in some applications than others, and increasing precision and resolution in a DMM usually means increasing price. In the Fluke line, you can choose a model with a basic accuracy of 0.25% (the 8022A), others rated at 0.1%, or the new 8050A bench/portable at 0.03%.

## Special measurements: getting more from your DMM.

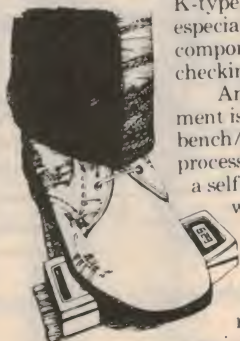
Actually, for all the variations in size, shape and semantics, most DMM's perform five basic measurements: ac and dc voltage and current,

and resistance. Prices vary according to the number of ranges and functions a DMM delivers.

The Fluke line includes DMM's with from 24 to 39 ranges, 3½ and 4½-digit resolution, and some unique functions you won't find in any other DMM. Additional measurement capabilities like temperature, dB, conductance and circuit level detection.

If your work involves temperature measurements, the new 8024A delivers direct temperature readings via any K-type thermocouple. This is especially useful in testing component heat rise and checking refrigeration systems.

Another talented instrument is our new 8050A bench/portable. The micro-processor-based 8050A features a self-calculating dB mode in which dBm readings are displayed automatically referenced to one of 16 selectable impedance ranges — a real timesaver when servicing audio equipment.



And of course no discussion of DMM's is complete without considering conductance — a Fluke exclusive featured on five of our low-cost DMM's — which allows you to make accurate resistance measurements to 100,000 Megohms. You can't do that with any ordinary multimeter, but it's a must for checking leakage in capacitors and measuring transistor gain.

## A handful of efficiency.

When every minute matters, your schedule is tight and so is your work space, you need a portable DMM that's fast and easy to operate. We designed our handheld DMM's with color-coded in-line pushbuttons for true one-hand operation: no need to hang onto the meter with one hand while twisting a rotary dial with the other.

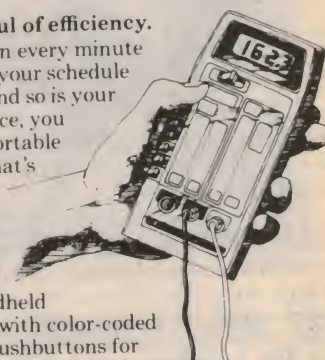
But there's more to convenience than fingertip control. The 8024A, for example, is also designed to function as an instant continuity tester, with a selectable audio tone to indicate shorts or opens. It also has a peak hold feature to capture transients.

## A word about warranties.

Last but not least, look closely at the company that manufactures a low-cost DMM. Their service is just as important as their product. Look for no-nonsense warranties, a large family of accessories, an established network of service centers and technical experts you can rely on.

That's how you'll recognize a knowledgeable supplier of low-cost DMM's, a company with experience, resources and a commitment to leadership in the industry.

Incidentally, you'll find it all at Fluke.



PRODUCT	FUNCTIONS	RANGES	DIGITS	BASIC DC ACCURACY	CONDUCTANCE	OTHER SPECIAL FEATURES
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8024A	9	26	3½	0.1%	X	Direct temperature readings; continuity input level detector with selectable audible signal; peak hold capability
8010A	7	31	3½	0.1%	X	True RMS, extra 10A range
8012A	7	31	3½	0.1%	X	True RMS, two extra low resistance ranges
8050A	9	39	4½	0.03%	X	True RMS, selectable reference impedances with direct readouts in dBm, offset feature

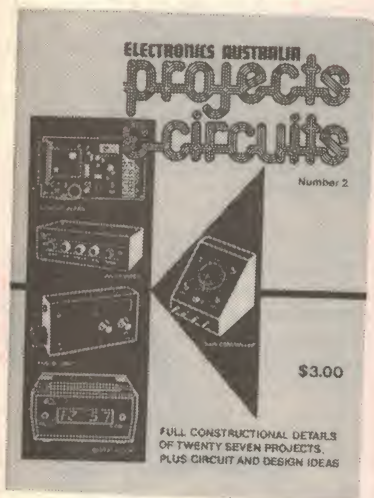
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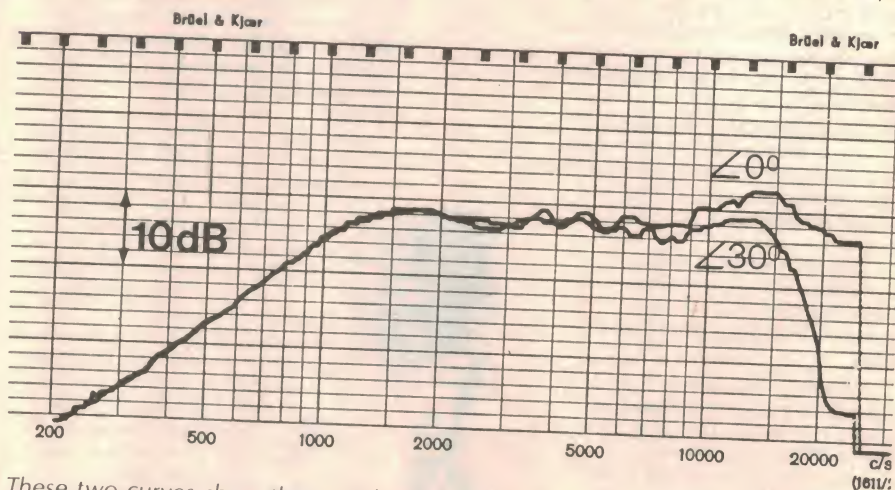
## PEERLESS PAS100 3-way Loudspeaker System

cabinets from scratch, you may vary the cabinet dimensions if necessary provided the enclosure does not vary by more than 10% from the designated volume of 100 litres.

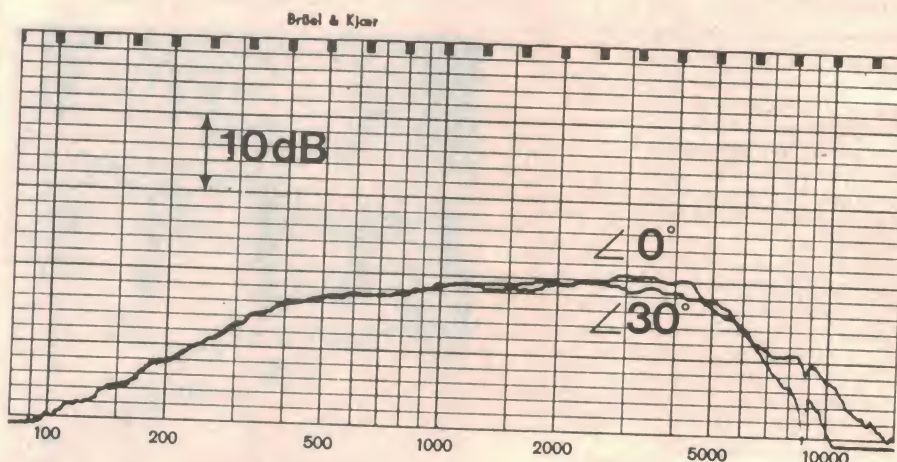
We understand that kit suppliers will sell their pre-cut timber kits in stereo pairs to minimise packaging costs. The normal practice with these pre-cut timber kits is to cut the sides, top and base from one strip of vinyl veneered board. Ninety degree grooves are milled where the joints will be, leaving the segments held together only by the vinyl

have available a large tube of PVC adhesive ("Aquadhere" is fine), some adhesive tape, and clear space on the floor covered with paper, in case you spill some glue. Oh, yes, and a scrap of clean cloth to wipe off any surplus.

Open the cabinet timbers full length on the floor and tentatively stand the baffle, tweeter end down, in what will ultimately be the top of the enclosure. The idea is that, when the panels are folded around it, the join where the two outer ends ultimately meet will be at the bottom, resting out of sight on the carpet.



These two curves show the sound pressure response curve of the tweeter (above) and midrange (below).



veneer. An additional groove is milled to take the baffle and rear panel. When adhesive is run into the grooves and the sides folded around the baffle, a rigid potentially airtight enclosure is formed.

While the surfacing material provides a surprisingly effective "hinge", allowing the panels to be folded and unfolded, we suggest that you don't tempt fate by idly demonstrating to yourself or to anyone else how it all goes together. Leave that until you are ready to do the job.

Before starting, make sure that you

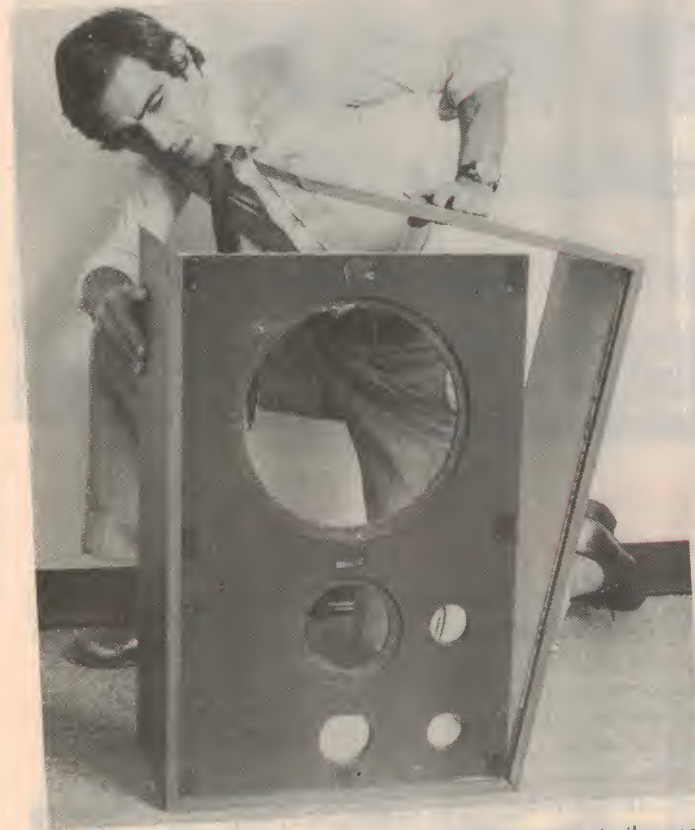
Remember also that the rebated side of the baffle is the front face.

Having worked out how everything will fit together, put the baffle aside and apply adhesive to all the 45° surfaces and to all surfaces of the rectangular slot for the baffle. Apply enough adhesive so that, when spread with a finger, it will wet all surfaces thoroughly and evenly. Wet the butt edges of the baffle all around and, for good measure run a thin, extra line of glue in the bottom of each V and in the bottom of the rectangular groove.

This done, slip the baffle into position,



## PEERLESS PAS100 3-way Loudspeaker System



*Assistant Editor Greg Swain shows how a typical precut cabinet kit goes together, with the top of enclosure on the floor. In this way, the corner joint will normally be out of sight.*

tweeter end down and rebated face to the front, without pushing it too hard into the groove. Now fold the sides and bottom carefully up around it, allowing the baffle to slip into its natural position, without straining either "hinge". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Hold them in this position with as many strips of adhesive tape as seem necessary.

Wipe away the surplus adhesive which will have been squeezed from the joints and put the enclosure aside overnight for the joints to set hard.

The second enclosure can be assembled

in a similar manner.

If you want to be doubly fussy, prop the two enclosures so that they are resting on one edge. Run a line of glue on the inside of the join, bridging the side and bottom. Allow the glue to dry and repeat the procedure for other edges to ensure an airtight seal.

Next, the back can be inserted and glued in position, but not before securing a brace with suitable cleats, to run between baffle and rear panel (as shown in our diagram). Then fix the rear terminal panel in place, making sure that the connecting wires are attached.

Now attach the crossover network

PC board to the underside of the brace mentioned previously and attach the leads from the tweeter and rear terminal panel. These merely push on. A diagram supplied with the PC board shows how the connections are made.

Mounting the tweeter is straightforward. Just fix the connecting lead to it. Drill the four pilot holes required for the self tapping screws, run foam tape around the rebate for sealing and drop the tweeter into place, having first attached the connecting leads. Then screw it down.

Next, push about half of the supplied filling material (Danfil or bonded acetate fibre) into the top section of the enclosure and make sure that it occupies the space evenly.

Follow the same procedure as for the tweeter when mounting the midrange unit. If you wish to incorporate the optional midrange attenuator network, wire it across the back of the midrange unit, as described previously. Connect it to the crossover PC board.

The woofer is held in place by means of four screws and four small metal brackets. Once again, drill pilot holes for the screws and run foam tape around the woofer rebate to aid sealing. Now push the rest of the acoustic filling material into the enclosure, making sure that it will not pack around the woofer. Then connect the wires from the woofer to the crossover PC board and fix the woofer in place.

All that remains then is to fit the grille cloth frame. Probably the simplest way to do this is to use Velcro fastenings.

After that, you can relax and enjoy the results of your handiwork.

Where do you buy these kits. Initially, in Sydney, they will be available from Electronic Agencies, 115-117 Parramatta Road, Concord, Phone (02) 745 3077. In Melbourne, contact G.R.D. Group Pty Ltd, 698 Burke Road, Camberwell, Phone (03) 82 1256.



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Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. The unique Sinclair BASIC interpreter: offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own

single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

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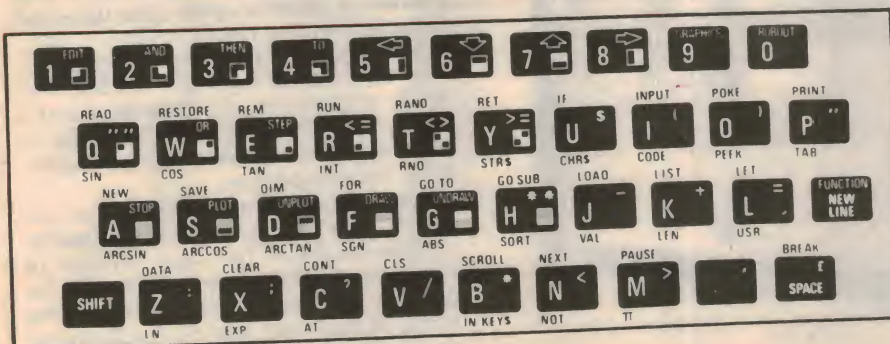
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ET5



# Benchmate: utility amplifier/power supply

by GERALD COHN

As its name suggests, Benchmate is a handy piece of equipment for your test bench. It incorporates an audio amplifier capable of delivering a little over one watt RMS together with a variable regulated power supply which can deliver voltages between 1.25V and 16V at currents of up to one amp.

Although the concept of this project is not new (a similar project was published in March, 1972 File No. 1MA/49) we thought it was about time for a fresh presentation of what can be one of the handiest pieces of gear to have on the workbench.

The circuit is a simple one using three low-cost ICs (one of them is a three-terminal adjustable voltage regulator). Add to these a few resistors, capacitors, diodes, etc and you have a useful piece of test equipment.

The circuit diagram gives an indication of the simplicity of the design. A pre-amplifier consisting of a TL071 op amp provides a gain of 100 (40dB) and is used with microphones and other low level sources. The power amplifier uses an LM380 power-amp IC. This has a fixed gain of 50 (34dB).

Two input sockets are provided, one for low input levels such as those from low impedance dynamic or electret microphones and the other for higher level input signals such as from a tape deck or audio oscillator. A single changeover switch is used to select the input, ie either high or low level input. The only other control as far as the

amplifier is concerned is the volume control.

The power supply section of the project uses an LM317 variable output voltage regulator. The output voltage which appears at a pair of terminals on the front panel is controlled by a potentiometer which is also mounted on the front panel. The ability to vary the output voltage of the supply is the major advantage that this new design has over its predecessor.

Looking at the circuit diagram we can see that the preamplifier uses the TL071 in the inverting mode, the gain being set by the combination of the 1k $\Omega$  and 100k $\Omega$  resistors. The non-inverting input is biased to half the supply so that equal positive and negative voltage swing can be achieved. The 150pF capacitor across the 100k $\Omega$  feedback resistor is used to roll off the high frequency response thus reducing the possibility of high frequency interference or instability.

The output of the preamplifier is AC-coupled to the power amplifier stage via switch S1, used to select high or low level input modes. The coupling capacitor at the output of the preamplifier has a 1M $\Omega$  bleed resistor to

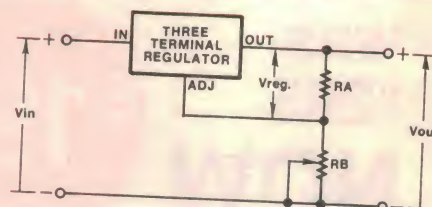


FIG. 1

charge it. This eliminates the switch-on "pop" when the low level mode is selected while the unit is switched on.

The supply to the preamplifier has been decoupled from the main supply using a 2.7k $\Omega$  resistor and a 100 $\mu$ F capacitor. This augments the supply rejection ratio of the TL071 as does another decoupling capacitor used at the non-inverting input.

The LM380 power amplifier is used in the inverting mode, with the non-inverting input tied to ground via a 47k $\Omega$  resistor. The inverting input is AC-coupled from the volume control potentiometer via a 2.2 $\mu$ F capacitor.

A 10 $\mu$ F capacitor connected between pin 1 and ground is a bypass capacitor used to assist in stabilizing an on-chip current source in the input-stage bias network. The power supply pin is pin 14 while pins 3, 4, 5, 10, 11 and 12 are all ground pins. Apart from being used as the ground termination pins, they also provide a thermal path for the heat dissipated by the chip.

The output (pin 8) is AC-coupled to the load via a 1000 $\mu$ F capacitor. A Zobel network consisting of a 2.7 $\Omega$  resistor and a 0.1 $\mu$ F capacitor is connected directly to the output pin to ensure amplifier stability at high-frequencies.

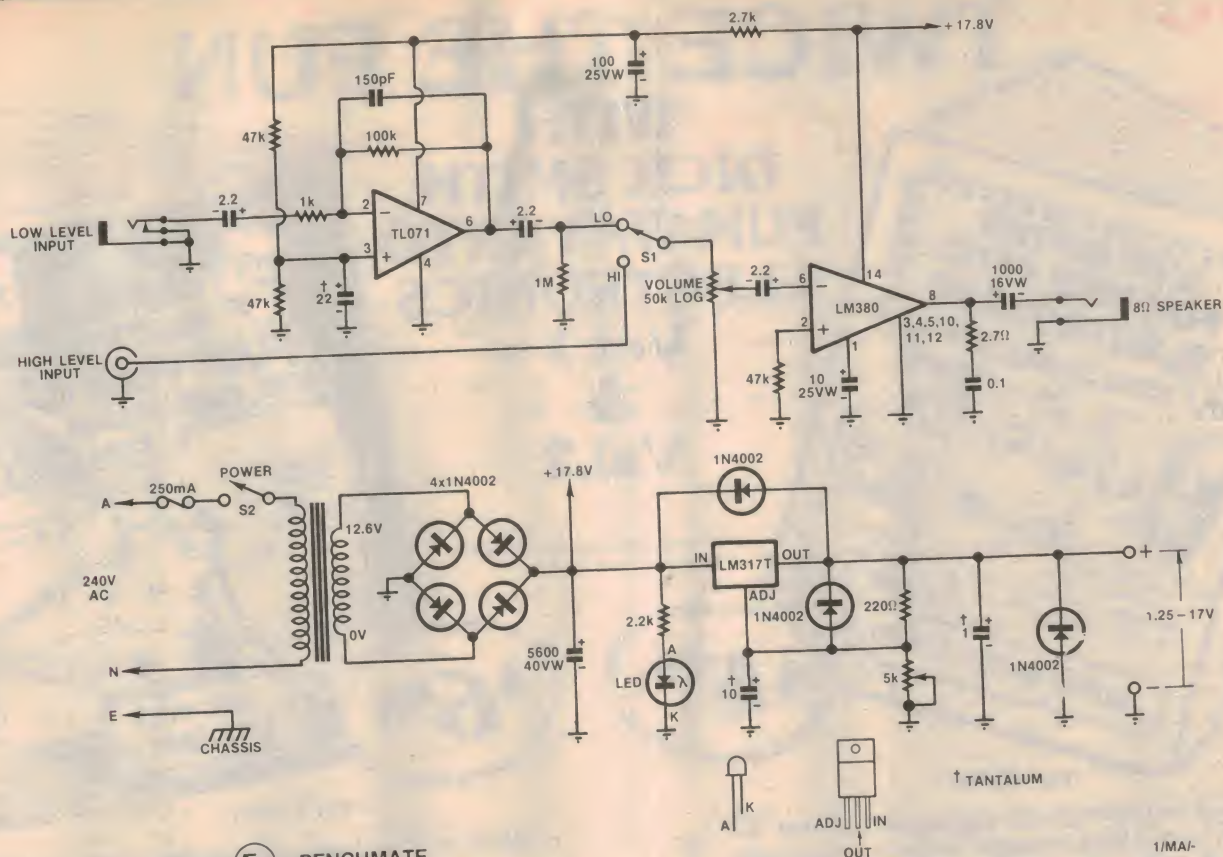
The variable power supply makes use of an LM317, three-terminal adjustable voltage regulator. The basic principle of operation of the power supply can be seen by referring to Fig 1. It should be noted at this point that the LM317 has a minimum or "fixed" output voltage of 1.25V (Vreg).

What the circuit of Fig 1 does is to apply the fixed output voltage, Vreg, across resistor RA. Assuming that no current is



The prototype can deliver 1.25W RMS audio output and includes a variable 1.25-16V regulated power supply (see specification panel).





**BENCHMATE**

The circuit consists of an audio preamplifier stage (TL071), an audio amplifier (LM380), and an adjustable voltage regulator (LM317T).

We estimate that the cost of parts for this project is approximately

**\$45.00**

This includes sales tax.

drawn by the adjustment terminal, then all the current flowing in  $R_a$  must flow in  $R_b$ .

The result of the current flowing in resistor  $R_b$  is to "jack up" the adjustment terminal so that the total output voltage is  $V_{reg} + V_{Rb}$ . As we have seen, the voltage across  $R_b$  is defined by the current through  $R_a$ , which in turn is set by the regulator output voltage,  $V_{reg}$ .

So we can define the output voltage for the circuit of Fig. 1 merely by the selection of the two resistors,  $R_a$  and  $R_b$ .

The formula to express this relationship is:

$$V_{out} = V_{reg} + (V_{reg} R_b) / R_a$$

This is the principle behind the circuit used here for the general purpose adjustable power supply.

We have given  $R_a$  a fixed value of 220Ω while  $R_b$  has been made variable using a 5kΩ potentiometer. A 10μF capacitor is connected between the adjust terminal and ground to improve the stability and to remove any ripple that may still be

Note that the LM317T voltage regulator must be isolated from chassis.

present at the output. The 1μF capacitor at the output is also used for improved stability.

The three diodes around the regulator (not those in the bridge) are used to pro-

tect the regulator in the event of a capacitive load being connected to the output while the power is switched off and also to protect against connection of another voltage source which could



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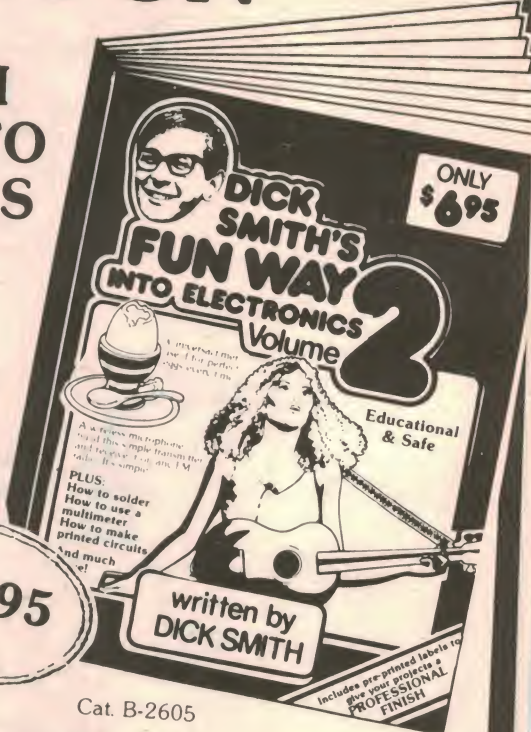
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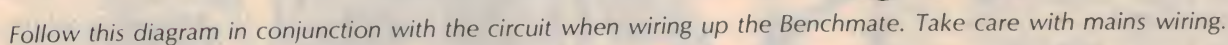
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The rectifier section of the power supply is shown in the circuit diagram as a full wave bridge, but we have made available the option of using a centre-tapped transformer and only two

We have designed a printed circuit board which contains all of the electronics. The board measures 120x70mm

The voltage regulator is mounted on the underside of the board so that it can be bolted down to the chassis when the board is mounted. This provides the heatsinking required when a lot of current is being drawn from the regulator. It should be noted here that the output terminal and the tag on the regulator package are at the same potential so that the regulator must therefore be insulated from the chassis when it is bolted down.

The usual procedure should apply when assembling the circuit board, such as starting with the resistors and the capacitors, and leaving the semiconductor devices until last. Make sure that all polarised components such as electrolytic capacitors and diodes are properly oriented before soldering them to the board.

The next step after the board has been assembled is to prepare the chassis for assembly. All the holes for the sockets, switches, binding posts, etc, have to be drilled and a front panel fitted. We have come up with a suitable front panel artwork, a full-size reproduction of which appears elsewhere in this article. Scotchcal panels should be available from

## PARTS LIST

- SEMICONDUCTORS  
7 1N4002 rectifier diodes  
1 LM317T adjustable voltage  
regulator and insulating washer  
1 LM380 14-pin power amplifier IC  
1 TL071 operational amplifier IC  
1 red LED and mounting bezel to suit

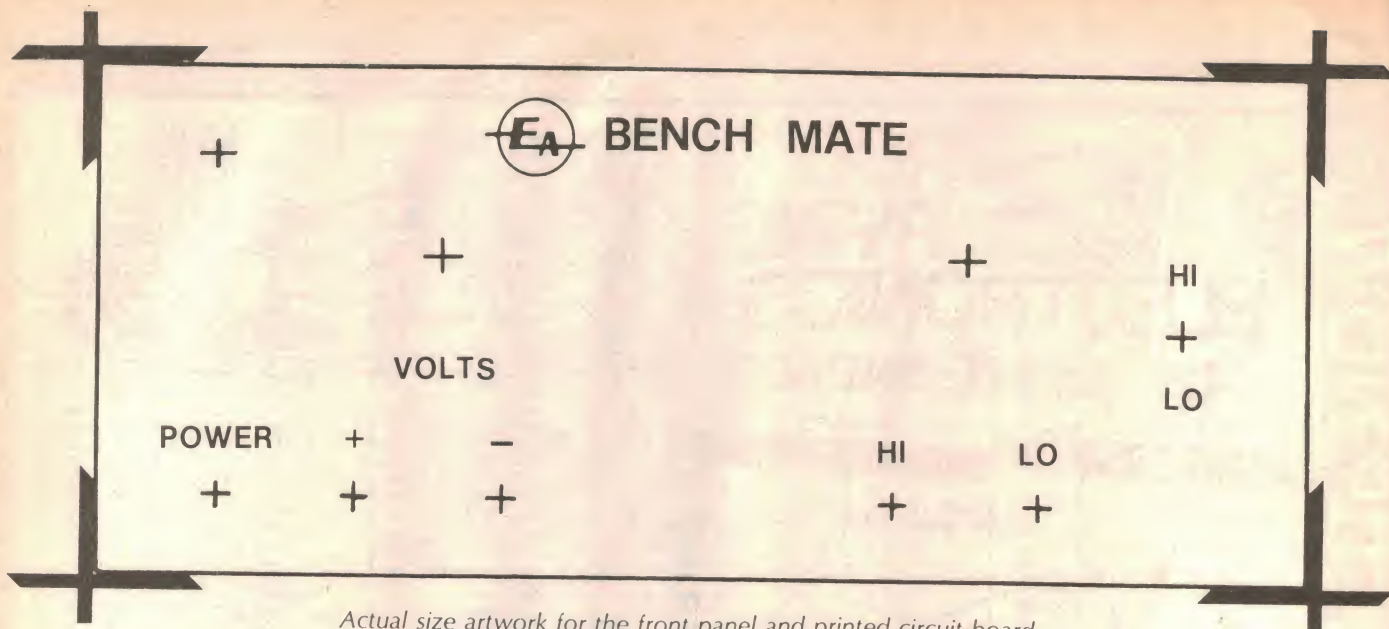
## CAPACITORS

- 1 5600uF/40VW PC electrolytic  
1 1000uF/16VW PC electrolytic  
1 100uF/25VW PC electrolytic  
1 22uF/25VW tantalum electrolytic  
1 10uF/25VW PC electrolytic  
1 10uF/25VW tantalum  
3 2.2uF/16VW PC electrolytic  
1 1uF/25 VW tantalum  
1 0.1uF metallised polyester  
1 150pF ceramic

RESISTORS ( $\frac{1}{4}$ W, 5%)

- 1 x 1M $\Omega$ , 1 x 100k $\Omega$ , 3 x 47k $\Omega$ , 1 x 2.7k $\Omega$ , 1 x 2.2k $\Omega$ , 1 x 1k $\Omega$ , 1 x 220 $\Omega$ , 1 x 2.7 $\Omega$





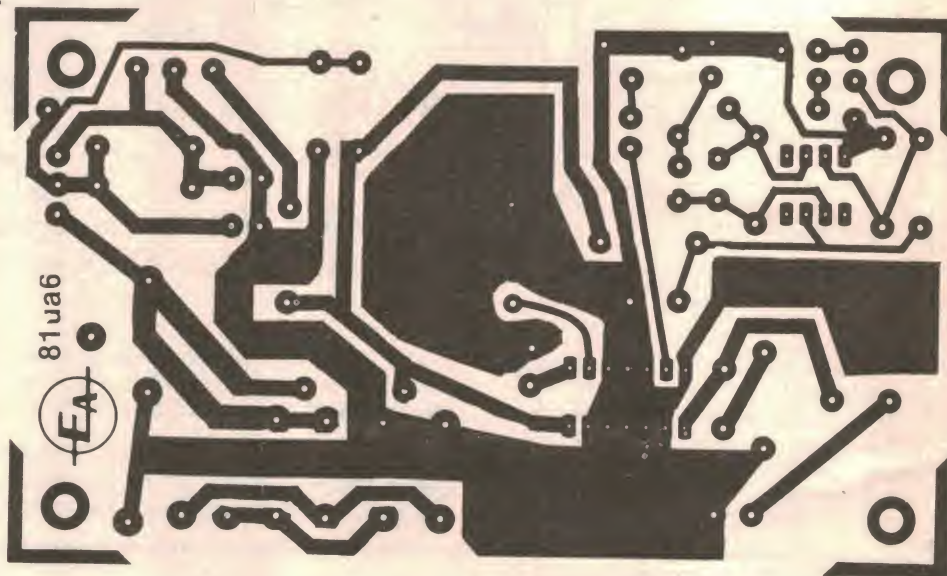
Actual size artwork for the front panel and printed circuit board.

## SPECIFICATIONS

POWER OUTPUT: 1.25 Watts into 8 ohms  
 INPUT SENSITIVITY: Low level 1mV; High level 70mV  
 TOTAL HARMONIC DISTORTION: (at onset of clipping) 0.3%  
 SIGNAL TO NOISE RATIO: 50dB with respect to 1mV  
 INPUT IMPEDANCE: Low level input 1k $\Omega$ ; High level input 50k $\Omega$ . ohm

## POWER SUPPLY SECTION

REGULATOR OUTPUT: (Hum and noise) typically 3mV peak-peak  
 MINIMUM OUTPUT VOLTAGE: 1.3V  
 MAXIMUM OUTPUT VOLTAGE: Typically more than 16V (no load)



the usual suppliers.

The case we used came from Dick Smith Electronics and consists of a bent aluminium chassis and a crackle-finish steel cover. The overall dimensions of the case are 184x60x170mm. These cases are now also available from other kit suppliers.

We have specified an insulated 6.3mm socket for the speaker connector, but these are not always readily available. Another simple method of insulating the socket from the chassis is to use a rubber grommet. We have in fact used this approach in our prototype.

After all of the switches, pots and sockets, etc, have been mounted, turn your attention back to the printed circuit board. Check the board once more and make sure there are no solder bridges or dry joints, and also check the orientation of all polarised components again. It pays to take that extra care at this stage, as it can save frustration later on.

If you are satisfied that there are no errors on the board, proceed to mount it

in the chassis. After the board has been mounted, make all the necessary connections to the pots, etc. Again, we advise you to check the wiring, as mistakes are easily made. The final step is to check the operation of the project. In order to carry out the tests you will need a loudspeaker, a signal source and a multimeter.

We will start the testing by having a look at the power supply section first. Connect the multimeter to the output terminals of the power supply and switch the unit on. Now slowly rotate the voltage adjust potentiometer in a clockwise direction. You should see the voltage rise, up to a maximum of around 16.5 volts. Now rotate the pot in an anti-clockwise direction and note that the voltage falls down towards zero. The minimum output voltage should be around 1.25 volts. Having confirmed that this section of the circuit is functioning properly, proceed to the amplifier test.

The amplifier test requires the use of a signal source. This can be in the form of

an audio sine wave oscillator with adjustable output or could even be a tape deck.

Connect the signal source to the high level input of the amplifier and make sure that the input has been selected by the switch on the front panel. Now connect a loudspeaker and switch the amplifier on. Slowly increase the volume and note that the signal can be heard in the loudspeaker. If the input signal level is not greater than 70 or so millivolts, then no audible distortion should be evident.

The same test can now be carried out with a suitable signal being fed into the low level input. Note that the preamplifier is now being used and that the input sensitivity is now in the order of 1mV.

Once all of these tests have been carried out you will have successfully completed another piece of test equipment for the work bench. We think you will agree that this is a very handy piece of gear.



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ET486	\$3.90	80 st 10 a	\$3.50
ET489A	\$3.50	80 sa 10	\$11.90
ET489B	\$3.50	80 st 10 b	\$2.50
ET496		80 trs 11	\$2.90
ET528	\$2.90	80 aw 10	\$3.90
ET539	\$2.90	80 dc 10	\$6.50
ET541	\$2.90	80 RAM 12	\$3.90
ET547	\$3.50	80 ls 12	\$3.50
ET549A	\$2.90	80 sa 10	\$9.50
ET560	\$1.90	80 rm 12	\$2.90
ET561	\$2.90	80 ad 12	\$2.90
ET562	\$3.90	80 fb 12	\$2.90
ET563	\$3.50	80 ga 12	\$6.50
ET566A	\$2.90	80 bm 10	\$2.90
ET566B	\$3.90	80 tc 12	\$2.90
ET567	\$3.50	81 sw 1	\$3.90
ET568	\$2.90	81 sp 1	\$2.90
ET572		81 dc 3 A	\$8.50
ET573	\$3.50	81 dc 3 B	\$9.50
ET576	\$5.90	81 dc 2	\$2.20
ET577	\$3.50	81 sp 1	\$9.50
ET578	\$2.90	81 ga 3	\$11.50
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ET583	\$2.90	81 hb 4 a	\$7.50
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EA 6/81

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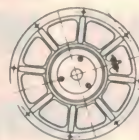
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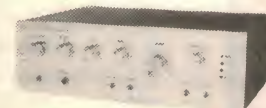
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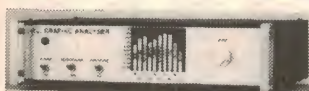
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Monitors ignition points and sounds alarm when preset speed is exceeded. No more speeding fines!

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## COLOUR GRAPHIC March EA ANALYSER



Take a look at the cover of March '81 EA to see what this great colour analyser can do. And note: our kit is absolutely complete—it works in full colour, includes case, front panel label. Beware of cheaper versions that don't include these in the price.

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receiver kit**

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**\$65.00**

**Own a  
microwave?**

Microwave ovens are a boon to modern living, but a leaking one is a very real danger. This simple to build kit checks any microwave oven for harmful leaks. ETI 724. Complete kit

**\$14.95**

**oscilloscope  
switch kit**

**SAVE \$10**

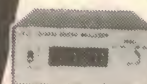
Convert your single trace CRO to dual trace with this simple to build kit. Kit includes

\*12V plugpack  
\*IC sockets  
\*Fibreglass PCB  
\*Metal front panel  
\*All hardware

**\$55**

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Analyser**

Keep your car in tune and save fuel. This unit measures RPM, dwell and battery voltage on any 4, 6 or 8 cylinder petrol engine. Complete kit

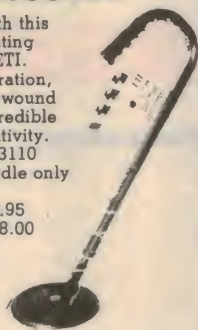


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EA March '81. There are hundreds of uses for this fantastic EA designed kit. Phone for full details of the kit.

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This unit converts a mechanical points system to a completely solid state system. Must be used with a CDI or transistor assisted ignition

system. Kit includes electronics only—you will need to fabricate parts to suit your vehicle. See article in June EA for full details.

### TV CRO adaptor

Converts your TV (colour or B & W) to a useful audio frequency oscilloscope.

(without mains adaptor) **\$29.40**

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Inexpensive digital meter measures from 1pF to 99.00uF in three ranges.

**\$59.90** Complete kit (see EA Sept 1980)

### Simple car alarm

Easy to build and install, highly reliable. At only \$12.50 it's cheap insurance.

**\$12.50**

### speaker protector kit

Fast acting, reliable. That's what you want from a speaker protector. This unit is a must when using high powered DC amps—if only for your own peace of mind.

**\$26.00**

### Dual power supply

Perfect for preamps, equalisers or for experiments with op amps.  $\pm 15V$  output. without transformer

**\$9.50**

### 4-input preamp

Suits virtually any power amp needing 1V drive. PC board and all parts, except transformer.

**\$29.50**

### Light & sound flash kit

Take spectacular action photos. Suits any flash unit—fully variable sensitivity & delay. See ETI Oct

**\$26.95**

'Le Gong' More popular than we ever envisaged! Forget that primitive mechanical doorbell—go electronic with this great EA kit. You'll make the Avon Lady's day!

**\$15** (pushbutton not included)

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### Peerless 3 way 100W rms Speaker System

Brand new top quality speaker system designed by EA using Peerless components (from Denmark). Full 100 watt (rms!) power handling. 300mm woofer, 50mm dome mid & 25mm dome tweeter. Available as a complete kit including woodwork (pre-cut but not assembled) or as a kit of the speakers and crossovers only.

Kit of speakers and crossovers only \$364 per pair. Complete kit including woodwork \$560 per pair.



Complete kit **\$560**

## Benchmate GREAT KIT SAVERS!



1W audio amp mike preamp, and variable regulated power supply (up to 16V) in one handy package. Perfect for the service bench. Complete kit—great value at just \$45.00

Designed by EA

Great Value **\$45**

Because of our policy of always keeping up with the latest in electronic kits we are discontinuing several of our range—and you the customer benefits—with gigantic dollar savings. These special prices will remain until stock is sold. So if you've been after one of these kits—buy now and save.

	WAS	NOW
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K-3457 LED Watch Dick Smith save \$3	\$17.50	\$14.50
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EA 40MHz Frequency Counter save \$10	\$99.50	\$89.50
EA VK Powermate (shortform) save \$5	\$34.50	\$29.50
CB Power Supply EA save \$4	\$29.50	\$25.50
ETI470 60W module save \$7	\$29.90	\$22.90
Impedance Bridge EA save \$5	\$37.50	\$32.50

## Kit buyers

**BEWARE!**

There are many companies advertising 'kits', but are they complete kits?

When Electronic Agencies advertises a 'kit', it contains all the parts needed to get the project going, unless we specifically exclude parts that many constructors will not need. The parts list supplied by the magazine is the parts list for our kits.

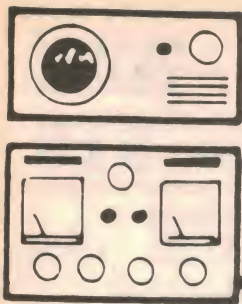
Unfortunately this is not true of all suppliers. We recently purchased a kit for the ETI Negative Ion Generator from a kit supplier. Their kit sold at a price higher than ours. Look at the differences:

ETI PARTS LIST	OUR KIT	THEIR KIT
240V-9V plugpack	240V-9V plugpack	Not supplied
5 needles	5 needles	Not supplied
100mm brass tube	100mm brass tube	Not supplied
Perspex	Perspex	Not supplied
100x100mm	100x150mm	Plastic case
Horwood case	Horwood case	Not supplied
Test PC board	Test PC board	Metal bolt
Nylon bolt	Nylon bolt	Not supplied
Solder	Solder—2m	5 resistors
7 resistors	10 capacitors	9 capacitors
10 capacitors	TIP31C x 2	TIP31B x 2
Price \$35.42	\$39.00	over \$40
Retail value of parts not included in their kit: \$22.35		

Value of parts not included: **\$22.35**

This might have been a mistake on their part—but why should you be inconvenienced by their mistakes? When you can buy an Electronic Agencies kit—and get it working. Remember, we are the kit specialists.





# The Serviceman

## How not to climax a day at the beach!

At the risk of seeming to flog a particular theme, I have another story this month about an exploding "maintenance-free" battery. I'm telling it because there appears to be an almost total lack of knowledge about the possible problems involved with these devices, if not on the part of the manufacturers, then certainly on the part of many of those who subsequently handle them.

In these notes for May 1979 I told the story of a maintenance-free battery which exploded in a Telecom workshop, when on "trickle charge". The operator involved received superficial acid burns to the eyes but, thanks to a workmate who manhandled him under a nearby shower, no permanent damage resulted.

It was subsequently established that the charge rate — about three amps — was excessive for this type of battery when it reaches full charge; a mistake attributed to "... a communication open circuit between the manufacturer and the user". Judging by the latest incident, this communication link is little better now than it was then.

For the benefit of those who may not have read the original story, here is brief summary of the maintenance-free battery. These batteries are almost completely sealed, with only a microcellular filter to release whatever gas may be generated in each cell.

### MINIMUM OF GAS

The battery is designed to generate a minimum of gas by using antimony-free lead grids for the plates, and on the assumption that it will be charged in typical automotive systems where the charge rate is progressively reduced to a suitably low level as the battery reaches full charge.

Loss of electrolyte is kept to a minimum by the reduced gassing, and by reduced evaporation due to the near total seal. The amount of electrolyte is also somewhat greater than in a conventional battery.

All of which adds up — in theory — to a very attractive device; a battery that the motorist can fit and forget for four or five years, when it would need to be replaced anyway. So what can go wrong? What

went wrong in the Telecom incident?

Excessive charge rate appears to be the main risk. Telecom's Material Inspection Branch concluded that the excessive gassing saturated the microcellular filter, causing a pressure build-up which lifted the filter from its seat. This not only released the explosive gas mixture to the atmosphere, but provided a flame path back into the battery.

At the time I reported the Telecom incident I mentioned that I had heard rumours of these batteries exploding in cars but, at that time, they were just that; rumours that were umpteenth hand with nothing factual to back them up.

But a few weeks ago I was able to get such a story at first hand, from a friend to whom it happened.

It all started one Saturday morning when my friend decided that he needed some rest and relaxation; like a spot of quiet fishing down the coast. So, in an

almost spur-of-the-moment decision, he loaded the fishing gear, his wife, and the youngsters into the car and headed south.

With the benefit of hindsight, he should have known better. He'd already had one omen that it was going to be one of those days; a flat tyre while returning from an early morning shopping trip. And, they say, bad luck often comes in threes.

His destination was a little known beach, popular with board riders and fishermen, about 90km (as the crow flies) south of Sydney, near Shellharbour. Allowing for longer distance by road, and traffic, it is about a two-hour journey.

### NOW FOR THE FISH!

Arriving at the spot he unloaded his fishing gear from the boot, aided by his small daughter who, on being assured that everything was out, slammed the boot lid shut. And that was unlucky incident number two, because the keys were in the boot. Fortunately he had some tools with him, and eventually gained access from behind the back seat, but it was foretaste of things to come.

The afternoon passed peacefully enough until about 6.30; just on dark. At that point it was decided to pack up, drive about 15km north to Wollongong for a meal, then make a leisurely trip home.

And then it happened. He turned the ignition key in the lock and — WHUMP! As he described it, it sounded as though someone had landed a house brick on the roof of the car. He got out, looked around, could see nothing wrong, and then tried the starter again. At that point he realised that he had no electrical power in any part of the car.

He lifted the bonnet but, in the dim light, could not at first see anything wrong. But while peering under the bonnet he became aware of drops of liquid falling on his head. Putting his hand on the underside of the bonnet confirmed that it was wet and, at the same instant, he realised that it was beginning to burn. It was battery acid.

Fortunately he had a can of water in the boot, with which he was able to



"I'm looking for an automotive service facility, with qualified personnel and state-of-the-art digital equipment, where they can accurately measure and adjust the storage battery input current with an appropriate degree of precision!"



sluice his head and hands and avoid further discomfort. Closer examination of the engine compartment revealed the horrible truth; the top of the battery had been blown clean away and broken into three pieces. The underside of the bonnet was covered with acid, which was dripping all over the engine compartment.

The immediate problem was how to get help. The beach was miles from anywhere and almost deserted. Fortunately, the last two board riders were just leaving and they kindly gave him a lift to the next town where he hoped he could get NRMA assistance. He wasn't keen on leaving his wife and family alone in the car, in the dark in the middle of nowhere, but there was no alternative.

Nor did things work out too well with the NRMA. There was only one patrolman on duty, and he was somewhere out in the wilds of Kangaroo Valley. They didn't expect that he could reach the car before midnight. And, in any case, he wasn't geared to provide a replacement battery.

Realising the hopelessness of this approach, he began ringing garages in the area. Most were shut by this time, but he finally found one that answered, and which also had a suitable battery. All he had to do was collect it and get it back to the car!

The only solution was a taxi, and the nearest available was at Wollongong. This arrived, took him to the garage, collected the battery, and then drove to the beach. It was now about 10.30 and it was a very relieved wife and family who greeted him, since neither he nor they had expected him to be away so long.

With the new battery fitted, and the old one in the boot, he drove back to the garage. The proprietor had offered him a few dollars for the old battery and, apart from anything else, he wanted to get rid of the messy thing as quickly as he could. It also provided an opportunity to hose out the engine compartment and the underside of the bonnet. (He repeated the exercise the next morning at home.)

He arrived home some time after midnight, at the end of a not-so-perfect day. Apart from anything else, the new bat-

tery and the necessary taxi fares had set him back close on \$80.00; a very expensive day out, and one which had done nothing to relieve the tension of the big smoke.

What had gone wrong? What had caused the battery to explode? The battery was about 18 months old and, when it was fitted, the salesman had assured him that it was the latest thing in batteries; maintenance free, he would have nothing to worry about for the life of the battery.

The salesman also made a big thing about the firm's policy of checking the electrical system of every car to which they fitted a battery. When they checked his car they announced that the charging rate was "... a bit on the high side, but she'll be right mate. With that new battery you don't have a thing to worry about".

### MORE CARE NEEDED?

But was this too casual an approach? Did the higher charging rate contribute to the explosion? In fact, it is hard to be sure just why the battery elected to explode when it did, some 18 months after it was fitted. The most obvious — but not necessarily true — explanation would be that pressure due to excessive gassing had probably built up on many previous occasions, but without actually damaging the filter.

On this occasion, perhaps aggravated by the long run, it proved just too much and at some time during the run, or shortly after, the filter lifted and released a hydrogen/oxygen mixture. We would now have to assume that enough of this mixture remained trapped under the bonnet for the several hours which the family spent at the beach, being ultimately triggered by a spark from the starter commutator.

And this is where the explanation seems to bog down. Could a sufficient amount of gas remain trapped for this long? It seems unlikely, yet the explosion occurred. Could there be a completely different explanation?

In fact, I have heard rumours, which I have been unable to track down at this time, to the effect that some such batteries suffer from some kind of

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598A	2.80	ETI 329	2.80	598B	2.80
81DC2	2.80	80IF12	2.80	81SP1	3.00
477	4.00	81SW1	3.50	80FB12	3.00
80SA10	7.00	328	2.80	80RM12	3.00
ETI 1500	9.00	80AD12	3.00	ETI 1500	9.00
80MV11	2.80	ETI 572	3.50	80RAM12	5.50
ETI 476	4.00	80LS12	3.20	ETI 476	4.00
255	2.80	247	2.80	80TRS11	2.80
80LBR12	2.80	80DC10	4.80	80AW10	3.00
80TC12	2.80	80BM10	2.80	80ST10B	2.80
80ST10A	4.50	80TM8B	2.80	EA80TM8A	5.00
568	2.80	327	2.80	ETI 477	3.00
ETI 475	4.00	ETI 457	3.00	ETI 326	2.80
80LPG9	3.50	80B7	2.50	80DM9	4.50
80TR9	3.50	250	2.50	564	10.50
ETI 324	3.50	80LL7	2.80	80M07	3.00
80PC7	3.00	80LL7	2.80	80M07	3.00
563	2.80	80CH7	4.80	565	3.50
80PP7B	2.50	467	4.00	149	2.80
80G6	4.80	80PP7A	5.00	80RF5	2.80
80D6	3.00	578	2.50	636	16.00
80PA6	12.00	78AF2	3.00	ET58820	10.00
80BB3	2.80	77CB12	2.60	78EK3	3.30
454	3.00	ET135	3.00	781A2	2.60
80AW4	4.00	BOHHS6	2.80	ET716	4.00
80C14	2.80	325	2.50	ET245	2.50
466	6.00	80PC4	3.00	78S3	2.60
80AU3	3.00	562	3.30	77PH12	2.60
264	2.50	453	2.80	80PG6	5.00
322	2.80	566A	2.50	80HLA5	2.50
80S1	2.50	80GPS3	2.80	80TV8	3.30
ET560	2.80	496	5.00	566B	3.00
ET151	2.50	496G	6.50	80F3	2.80
79D10	2.80	80CM3A	3.20	ET152	2.80
79T11	2.80	561	2.80	726	8.00
ET262	2.50	80GA3B	3.20	80CM3B	2.80
ET150	2.80	79SB10	2.80	455	3.00
79PG9	3.00	ET452	4.50	80GA3A	5.00
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79PS6	2.80	79TT7	2.60	79R18	2.80
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6800	8.50	ET574	2.80	79W9	2.80
79UPS6	2.50	ET814	2.80	ET731	3.00
ET144	3.50	79SR8	2.80	ET575	2.50
79R05	3.00	79UT8	3.00	ET725	3.50
77E02A	3.50	79FR6	3.50	79TRF5	2.50
ET320	2.50	ET472	3.00	79M8	2.80
ET595	2.80	79C17	4.80	ET148	2.50
491	4.50	79SA5	8.00	ET724	2.50
79PS3	2.60	ET254	2.50	79KB7	2.80
79P1B	2.80	79E02C	2.50	ET651	4.50
79C1A	3.00	ET249	2.80	ET471	5.50
142B	4.00	ET253	4.20	79E02B	4.00
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79IT2	5.00	78Se3	4.00	ET470	3.20
		79P1A	2.80	79A3	3.00

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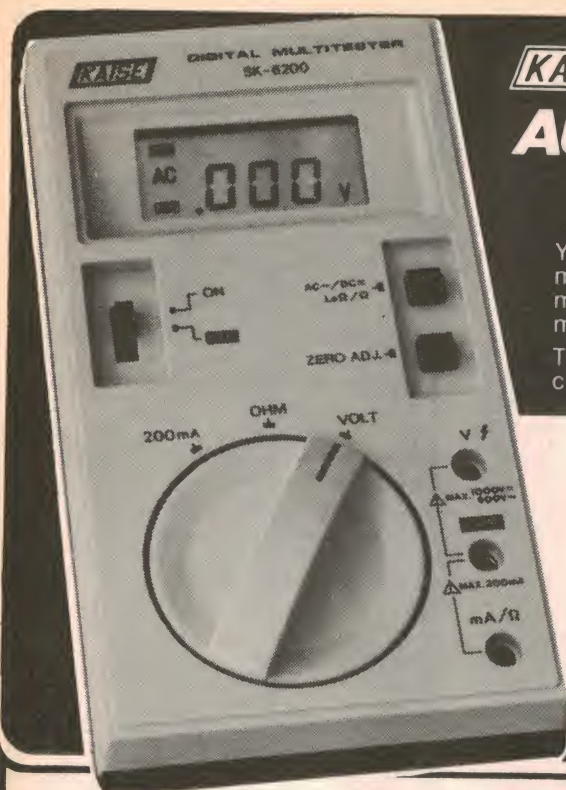
### VCRs — and associated problems

In some push-button tuned receivers, the time constant of the line flywheel circuitry is reduced when they are switched to the channel designated for use with video cassette recorders. The provision appears to be unnecessary with modern VCRs and it has the disadvantage of making that channel more subject to video pulling, particularly if the AGC level adjustment is not critically adjusted.

It can also cause problems if the button is used for normal channel 0 reception. Mains hash can cause objectionable line jitter.

Last but not least, pre-recorded cassettes having non-standard vertical sync pulses — in an effort to frustrate copying — may fail to produce proper vertical locking in a significant number of receivers. Those with accessible vertical hold controls can usually be nudged into sync, but designs without accessible vertical sync may suffer from severe, even continuous, vertical rolling.





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- Single button zeroing
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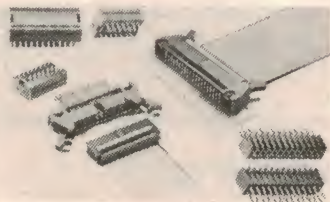
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Model 7010 7" 12V 35/50W	ea	\$3.78
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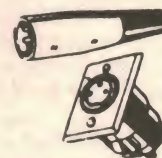
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## THE SERVICEMAN — continued

structural fault. But, regardless of the explanation, the fact remains that this battery did explode — and others could possibly explode in the same way.

More to the point, the effects could be much more disastrous. This incident was bad enough; the inconvenience, the expense, the worry and trauma for a wife and family alone on a lonely beach, and the very real risk of long term damage to the car in spite of all possible precautions.

But at least no one was hurt. It is not unusual for home mechanics to activate the starter while working under the car bonnet, possibly with their face only inches from the battery. In circumstances a person could easily be blinded and it is possibly only good fortune that this has not yet happened.

Perhaps it is time the Consumer Affairs Bureau — and their counterparts in other states — took a long hard look at these devices (1) to assess any degree of danger and (2) to at least ensure that all users are adequately warned of any potential hazards.

In the meantime I will do my best to follow up the rumours I mentioned. Hopefully, I may be able to get answers.

### FADING TV PICTURE

From my own workbench the most interesting story this month concerns a Rank Arena model 2603, and one of the main points of the story is its similarity to a previous fault and how this experience helped. The previous story was related in my notes for February 1980 and concerned a Rank Arena, 2201, but the relevant part of the circuit is virtually identical in both sets.

As in the previous story, the original call had nothing to do with this fault. It was about a snowy picture, and the customer suspected — correctly as it turned out — that he had antenna trouble. He is in a poor location and needs all the signal he can get to obtain a good picture.

There were several things wrong, including the antenna itself, but the main culprit was a very old and very tatty ribbon feeder. When the weather was warm and dry it performed tolerably well, but when it rained, or even at night when dew formed, it was virtually useless.

A general overhaul of the antenna, plus a length of good quality coax and a balun, cured that problem but then the owner casually mentioned that the picture had a habit of going dark after the set had been running for some time. He assumed that this had been due to the faulty antenna and loss of signal at night. I had some doubts that the explanation was as simple as this.

Fortunately, I was able to observe the effect. Having heard the customer's story I switched the set on and noted that it

presented one of the morning test patterns at what appeared to be normal brightness. Then I went out to the truck to fetch a service manual. When I returned the station had commenced its program — and the picture was noticeably darker.

I checked the beam limiter setting which, in some circumstances, can override the brightness circuitry, and found nothing wrong. Then I checked the sub-brightness control and found I could restore normal brightness with it, but I wasn't sure why it needed to be adjusted.


At that point I noticed something about the picture which prompted me to switch to another channel displaying a test pattern. Sure enough, I was right; the set was overscanning badly in the vertical mode. It was then that I recalled the February 1980 story. That had been one of the symptoms and although the other major one, loss of chroma lock, was not

evident, I was immediately suspicious.

The trouble on that occasion had involved the 19V rail, normally regulated by a transistor (TR505) and a zener diode network (D555, D559, and D560). This rail supplies, among other things, the vertical deflection board and, if it fluctuates, the vertical deflection also varies. It also supplies the "video out" board which includes the sub-brightness circuit.

The meter confirmed my suspicions; instead of 19V I had 26.5V and, what was more, this voltage appeared on both the collector and emitter of the regulator transistor. My first thought was that the transistor had broken down, but the previous experience suggested I should not be too hasty. I checked the base voltage and found that it was of a similar value.

In fact as in the previous case, one of the two diodes in the zener network was completely open circuit. A new diode brought the rail back to 19V. The overscan vanished and the sub-brightness control could be re-set to its former position.

Such is the value of experience. 

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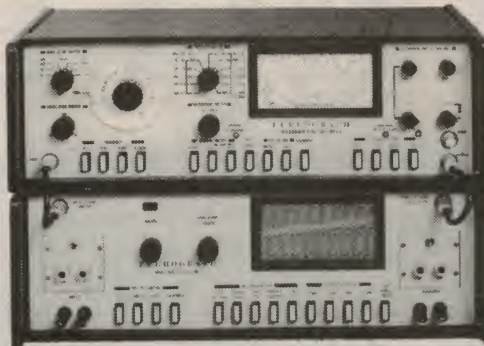
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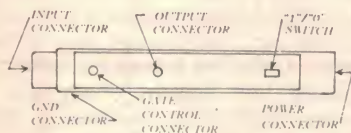
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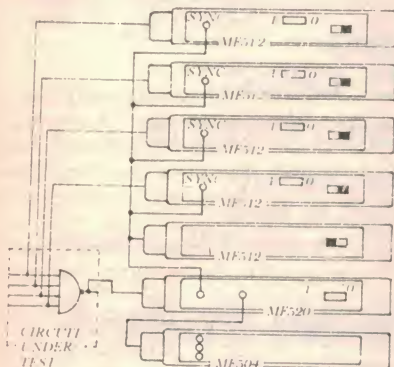


# LOOK!! LOGIC PROBES & PULSERS AT REASONABLE PRICES



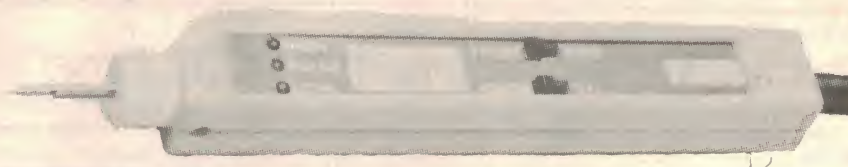
## LOGIC SIGNAL GATE MF520

The Logic Signal gate MF520 is used to extend the operation range of the logic probes. Its main function is to open a small time window, and let the logic probe indicate a signal state in the window. A gate control signal is required to mark the beginning and ending of the time.



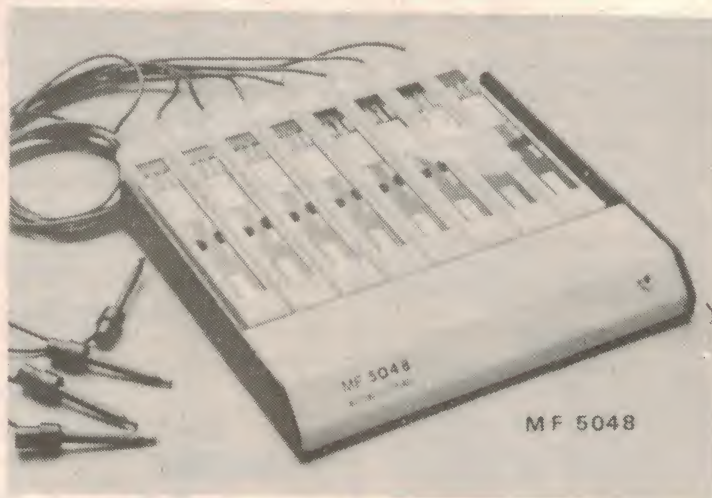
## TRUTH TABLE TESTER MF5126

The tester is designed to test the truth table of combinational logic circuit on PC board, such as gates, decoders, multiplexers, arithmetic functions etc. It can isolate the circuit under test from other devices on the PC board. It comprises six model MF512 logic pulsers, one MF504 logic probe, and one MF520 logic signal gate. Logic pulsers are used to set input state of the circuit under test. Logic probe and logic signal gate are used to observe the output states of the circuit under test.



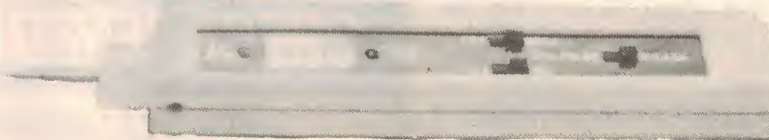
## LOGIC PROBE MF504

The MF504 Logic Probe is designed for quick servicing and checking of integrated logic systems. With its unique multi-lamp readouts, the logic probe visually displays the presence of correct logic levels by illumination of coloured readouts. Incorrect logic levels are shown by the absence of coloured readouts.



## 8-BIT MONITOR MF5048

This instrument comprises eight MF504 logic probes and one MF420 probe rack. Mounting logic probe parallel on probe rack will ease viewing of the operations of counters, shift registers and data bus etc.



## LOGIC PULSER MF512

A logic pulser is a valuable tool for trouble-shooting digital equipment. The use of a pulser to inject pulses into circuit nodes without cutting traces, removing ICs, on monitoring circuit response with a logic probe, is an effective method of locating faults in logic, connections, or components. The pulser produces high energy, short duration voltage pulses of a logic state opposite to that of the node under stimulation.

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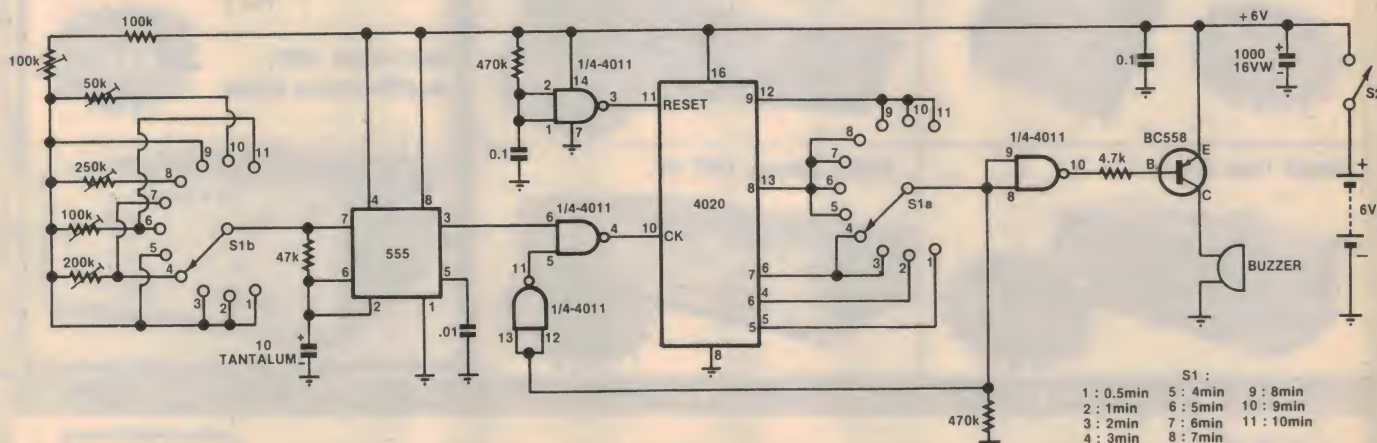
# I.C. Dispensers



## CIRCUIT & DESIGN IDEAS

We invite readers to submit circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. Sources of material must be acknowledged and will be paid for if used. As these items have not necessarily been tested in our laboratory, responsibility cannot be accepted.

## Intermediate intervals for the Utility Timer



Whilst the simple Utility Timer described in the August, 1978 issue of EA provided for selection of the timed interval in a binary sequence (1,2,4,8,16,etc,) for some applications a linear selection (eg. 1,2,3,4,5 etc) of timed intervals may be preferred. The Timer may be modified to provide such linear time increments by replacing the single-pole selector switch with a two-pole version, and the addition of four trim pots.

To obtain the intermediate time intervals, clock frequency has to be lowered for a desired counter output, eg. reducing the clock rate by 33⅓% on the two-minute setting will produce an interval of three minutes; reducing by 20% on the

four-minute setting gives five minutes.

Referring to the circuit it will be observed that the 100k $\Omega$  CALIBRATE trimpot is removed from the board and interfaced with the new trimpots by the second pole of the selector switch, such that the frequency of the 555 oscillator can be varied according to the selector position.

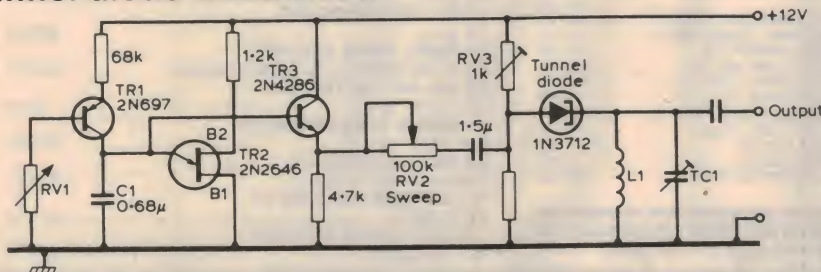
Practically it is preferable to mount the trimpots on a tagstrip which can be bolted to the front panel, rather than soldering them directly to the switch. Adjustment of the modified unit will take some 50 minutes, with the 100k $\Omega$  standard rate trimpot being adjusted first – initially on the half-minute setting, then the four-minute setting for finer adjust-

ment. Next the 200k $\Omega$  trimpot (50% slow) can be adjusted for the three-minute period, followed by the second 100k $\Omega$  trimpot (25% slow) for the five-minute period. The seven-minute period is set by the 250k $\Omega$  trimpot (75% slow), and finally the 50k $\Omega$  trimpot (12½% slow) is adjusted for the nine-minute position.

It should be noted that the four-minute adjustment sets the 1/2, 1, 2, 4 and 8 minute positions, the three-minute adjustment the 3 and 6 minute positions and the five-minute one the 5 and 10 minute positions.

B.M. Byrne,  
Indooroopilly,  
Qld.

## Tunnel-diode wobbulator



This circuit is claimed to provide an effective method of obtaining a sweep frequency source throughout the range from 10 to several hundred MHz. It relies on the stable characteristics of a 2N2646 unijunction transistor and the 1N3712 tunnel diode to perform "with no compromise" a function that usually requires an expensive piece of test equipment.

The linear sweep is set by RV1, sweep

depth by RV2, while RV3 adjusts the bias to the negative resistance region on the tunnel diode HF/VHF oscillator in order to accommodate the characteristics of the particular tunnel diode. The resonant circuit, L1-TC1, tunes to the required centre frequency.

(From "Radio Communication",  
August, 1980.)

## Modified "Prospector" metal locator

The metal locator described in the November 1979 issue of EA is sometimes difficult to set to a low growl, as suggested, because of a spurious oscillation which can occur when the two oscillators are very close to being harmonically related. This arises because the D flipflop can sample the reference oscillator very close to the level transition points, with any phase jitter producing the spurious high frequency tone at the flipflop output.

By adding a 4013 dual D flipflop to the circuit the problem can be overcome. One half of the 4013 is used to divide the reference oscillator frequency by 2; while the second half is used to synchronise the edge transitions of the

(Continued on p85)



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EA 6/81

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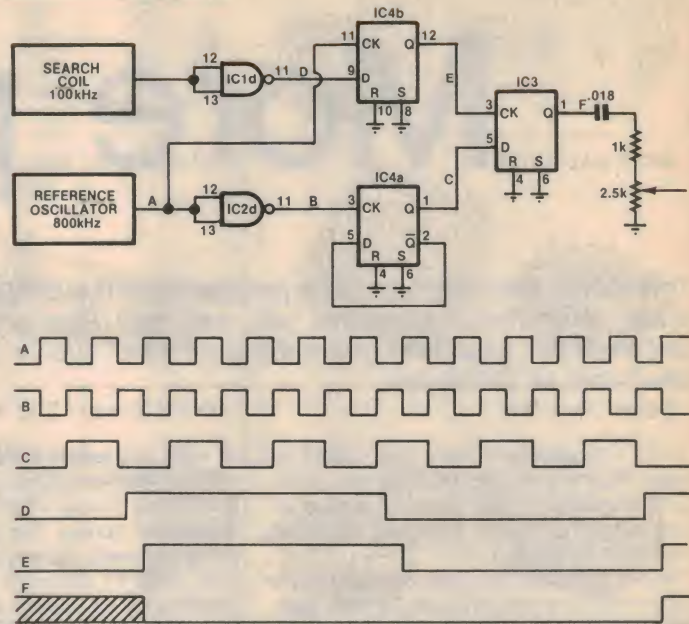
## "Prospector" metal locator ctd ...

search coil oscillator to the reference frequency.

Referring to the circuit diagram, the existing NAND gate IC2d is used as an inverter so that the clock inputs of the new flipflops, IC4a and IC4b, are driven out of phase. The result of this is that IC3, the existing flipflop, can only sample the output of IC4a midway between transitions. Note that this halves the effective reference frequency. But, whilst the sensitivity is thus slightly reduced, the modified metal locator still gives adequate sensitivity.

Modification of the unit is quite simple. The additional 4013 is mounted piggy-back fashion on top of the existing 4013. Pins 4, 6, 7, 8, 10 and 14 are soldered directly to the similarly numbered pins, whilst the remaining pins are bent at right angles and connected to the existing circuitry by flying leads. It is necessary to cut the tracks leading to pins 3 and 5 of IC3, and drill five holes in the printed circuit board to make connections to either side of these two

*Circuit diagram for the modified "Prospector" metal locator. Waveform diagrams are shown for points A, B, C, D, E, F.*



breaks, and to pin 12 of IC2d.

Operation of the modified metal locator is as described in the original article. The beat frequency should be set to

a low growl, so that the presence of metal leads to an increase in frequency.

D. Edwards,  
Campsie, NSW.

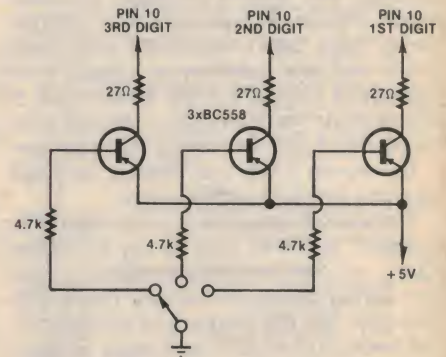
## Decimal points for the 200MHz Frequency Counter

A relatively simple modification enables illumination of decimal points in the 7-segment displays of the EA 200MHz Digital Frequency Counter, (published in August and September 1978) without creating any problems from random counting as may occur (due to hash) when simple switching from the +5 volt rail is attempted.

The change involves feeding (via series resistors) the decimal points (pins 10) of the displays from the collectors of three small-signal transistors, whose emitters are tied to the +5 volt power supply rail. Normally two of the transistor bases are floating, whilst the third base is returned to ground (via a 4.7kΩ) resistor through the spare pole on range selector switch.

This turns the transistor "on", thus illuminating the appropriate decimal point. All resistor values have been chosen so as to give equal brightness with the other segments of the displays.

Assembly of the additional circuitry may be carried out on a small piece of matrix card or Veroboard, which can be located on the left-hand side of the instrument above the blank section of the printed circuit board. By using a long solder lug bent at 90°, and then at 90°, again; and attaching the tip to the Veroboard, the eye of the lug can be held under the head of the mounting screw at the left-hand front of the p.c.b. Unshielded hookup wire may be used to connect to the range switch as the leads



are at ground potential.

N.P. Wilson,  
Stafford, Qld.

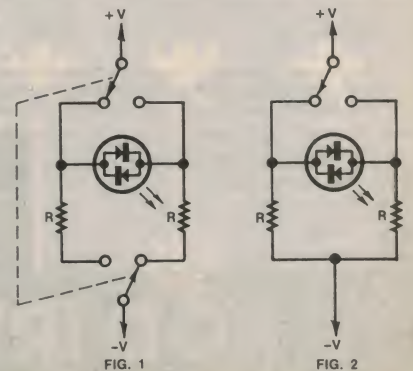
## Bi-colour LEDs indicate switch position

Bi-colour (red/green) LEDs can be used to give visual indication of the status of a toggle or other-type two position switch, provided the switch has one or more unused poles. Direction of current flow through the bi-colour LED is changed according to switch position. Two variants are possible, depending upon the number of poles available.

Fig. 1 shows the preferred arrangement, with current flow being

controlled by two poles. The alternative arrangement shown in Fig. 2 requires only one pole, but has more than twice the current drain. Allowing for 10-15mA forward diode current,  $R = (V-2)/0.012\Omega$ . In practice the intensity of the green LED is less than the red, so some experimentation is necessary to find the optimum values for the resistors.

R. Tregea,  
Pennant Hills, NSW.





# More programs

This month we have five more programs for the DREAM 6800 computer. With these programs you can play Space Invaders, learn Morse code, watch the generations of "Life" evolve, or perhaps win the Pools or Tattsлото!

Our first program was contributed by Gary Wayne Temple, of Kogarah, NSW. It's a version of the popular Space Invaders game, with excellent graphics and sound effects.

As Mr Temple describes the game, the player has five ground tanks to play with. By pressing key four he can move the tank left, pressing key five moves right, and the "F" key will fire a missile at the invaders. Four animated invaders march back and forwards across the screen, firing at the player's tank.

When a player's tank is hit a beep sounds, and a new tank appears immediately. If an enemy attack craft is hit it will blow up, freeze while the beep sounds, and then the game will continue. When the player's five ground tanks have been destroyed the game ends and the number of attack craft destroyed is shown at the bottom left of the screen. You can play over and over again simply by re-starting the program.

The action is fast and furious, so you'll need to be alert for this one!

The second program is a novelty Pools number selector, sent to us by Bruce Clark, of Margate, Queensland. We're not saying that you'll win the Pools with this one, but the chances of winning using your DREAM 6800 are about as good

as with any other method!

When the program is loaded and run, the words "Lucky Pools Nos." are slowly displayed across the screen. Then the program waits for any key to be pressed and picks 11 different random numbers between 1 to 55 and displays them. To pick another 11 numbers simply press a key again.

Just so Victorian readers won't feel neglected, we are also presenting a program to select Tattsлото numbers. This program, contributed by Alex Lia, of Reservoir, Victoria, is designed to give from six to 15 different random numbers between 1 and 40, so that it may be used for both normal games and "systems" type entries.

To use the program, start it running in the normal way and enter the type of system entry required. Press seven for systems seven, F for systems 15 etc. Pressing a number between 0 and 6 will display six random numbers for use in a single game. If the numbers are not to your satisfaction, pressing the appropriate systems number will cause the cycle to repeat, generating a new selection of random numbers.

The next program from Mr Roger Graham, of Gerringong, NSW, generates random groupings of Morse code for

practice or instruction purposes. Mr Graham writes:

In the form presented, the program generates Morse code at approximately 10wpm (word per minute). Each character sounds from the speaker, and is displayed on the screen after a brief delay. The user can select letters only, or numbers only, or mixed letters and numbers. When a random group of five characters is completed, the screen clears and another random group begins.

By inserting appropriate values where indicated below, the speed of the code can be set at various values (approx 5, 6½, 8, 10, 11, 14, 22wpm). In addition the space between individual characters can be lengthened, as can the space between five letter groups. This permits a learner to hear each character generated at the desired code rate, yet provides "thinking time" between letters or groups. A maximum delay of five seconds is available in each case.

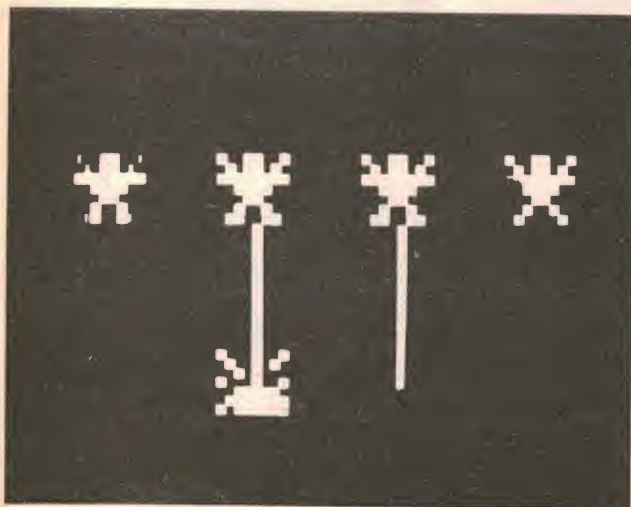
The program fits into the 640 bytes available in the DREAM memory (with two bytes to spare): A brief outline of the program follows:

For Morse at 10wpm, each dot is approximately 0.1 seconds long. Let's call this one time unit. Then each dash is three units long. The space between dots or dashes is one unit, between characters three units, and between words, seven units.

Instructions at addresses 0370 to 0372 generate a bleep one unit long. Instructions for a 3-unit dash are at 0378 to 037A. A subroutine at 03A4 to 03AE generates a time delay of one unit. Further instructions at 03B0 to 03B2 generate a 2-unit delay, while instructions at 03B4 to 03B6 produce an additional 4-unit delay. Changes to the program at these five locations can alter the speed or the spacing between characters.

Suitable groupings of dots, dashes and spaces generate the required 36 characters (26 letters, 10 numbers).

The visual display for each character follows the ASCII format, a seven-by-five matrix of dots. The data for display of 36 characters should occupy  $36 \times 7 = 252$  bytes of memory, but by suitably overlapping letters in the design stage (so that the bottom of B becomes the top of an R, and so on) the data can be fitted into 196 bytes, from 03BC to 03FF,



*DREAM Invaders. This still photo doesn't really capture the excitement. Note that the tank has been hit and is blowing up, and the invader's are moving, creating the double-exposure effect.*



# for the DREAM

and from 0080 to 00FF. Each character is displayed when required by the D127 command at address 03B8.

A set of 36 consecutive instructions from 021E to 0264 controls production of the 36 characters. Random selection from this group of 36 is achieved by the program from 0204 to 020E. The instruction C07E at address 0206 generates numbers ranging from 00 to 7E hex (0 to 126 decimal, even numbers only). Only the values from 00 to 46 hex are kept, (0 to 70 decimal). Any number bigger than 46 hex is discarded. The command B21E adds the random number to the address 021E, thus in effect selecting at random any one of the 36 consecutive addresses beginning at 021E. If this point is understood, the user can make changes to select letters only (26 addresses beginning at 021E) or numbers only (10 addresses beginning at 0252) or any other selection such as the first half of the alphabet, or the second half etc.

Thus to generate letters only, the instruction at address 0204 should be 6332 (because 32 hex = 50 decimal, and the program thus selects the address of letter A or any of the 25 subsequent addresses).

To generate numbers only, the instruction at address 0204 should be 6312 (because 12 hex = 18 decimals, so the program can select the address of numeral one or any of the nine subsequent numerals up to 0). And of course the instruction at address 020E should be altered to B252, since 0252 is the address at which the list of 10 numerals begins.

To alter the speed of the Morse code while still keeping the correct relative spacing between dots, dashes, characters and groups, changes to the program must be made at five addresses as shown in the table below:

While it may seem clumsy to have to adjust five different variables when changing speed, it does make for a versatile program. In particular, you can

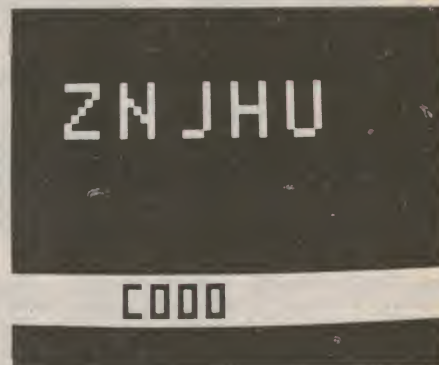
allow long delays between letters or group, while still having each character sounded at the speed at which you eventually hope to read the code. For example, by adjusting the instruction at address 03B4 to read 6BFF, the program will generate a full five letter group at normal speed, then allow you five seconds thinking time before commencing the next group. By altering the variable B at address 03B0, the delay between characters can be lengthened. An instruction 6B32 at this address gives a delay of about one second, while 6B64 gives a delay of two seconds. Maximum delay of about 5 seconds occurs when variable B = FF.

Tom Moffat, of Fern Tree, Tasmania, contributed the next program, an implementation of the fascinating game of "life" for the Dream 6800. He writes:

Life is one of the few games that can only be played efficiently by a computer, although it wasn't originally designed with the computer in mind. When first announced in "Scientific American" back in October 1970, it was suggested that Life should be played on a large draughts board, using small poker chips as counters — a most time consuming business. Three pages into the article it was finally revealed that British mathematician John Conway, the inventor of Life, used a PDP-7 computer with a video display to observe some long-lived populations.

The game of life is simple yet elegant. It is played in an array of cells, each of which can be alive or dead. When studying the theory of Life, the cell array is considered to be infinite in size, but in a computer, Life obviously has to stop somewhere. In the DREAM 6800 version to be described the cell array is limited to 2048 cells in a 64 by 32 format.

The complete array and the cells living in it are considered to be a 'generation' at any moment. From time to time a whole generation is replaced by another one, with some cells surviving, some dy-



The screen display of the Morse code program. The DREAM's speaker sounds the code before the letter is displayed.

ing, and others being born. Which cells are to live in the next generation are determined by studying each one in the existing generation in relation to its neighbors. Every cell has eight potential live neighbors, above, below, beside, and diagonally adjacent to it.

A cell's fate is determined as follows: A live cell will die in the next generation if it has less than two live neighbors (loneliness) or more than three (overcrowding). A live cell will survive into the next generation if it has two or three live neighbors. A cell will be born in the next generation if it has exactly three live neighbors.

As you can see a computer running Life has quite a job to do. Eight tests must be done for each cell and a count kept of the number of live neighbors. Then it has to decide the future of the cell being considered. For an array of 2048 cells, this involves more than 16,000 cell tests per generation.

Even in a computer, Life can plod along at a snail's pace. One 'Basic' program from a book of computer games takes a full minute to run each generation in a 6800 system.

The December 1978 issue of 'Byte' carried four articles of Life. One of these advertised a Life program for the 6800 using 1.5 K of memory, running a generation every six seconds in an array of up to 2016 cells. This one actually used two cell arrays, one for the existing generation and another for the new generation. When the new generation was completed it was transferred down into the first array.

The DREAM 6800 computer is a natural

Address	5½ wpm	6½ wpm	8 wpm	10 wpm	11 wpm	14 wpm	22 wpm	Ratio
0370	6C08	6C07	6C06	6C05	6C04	6C03	6C02	1
0378	6C18	6C15	6C12	6C0F	6C0C	6C09	6C06	3
03A4	6B08	6B07	6B06	6B05	6B04	6B03	6B02	1
03B0	6B10	6B0E	6B0C	6B0A	6B08	6B06	6B04	2
03B4	6B20	6B1C	6B18	6B14	6B10	6B0C	6B08	4

This table shows the addresses and data which set the speed of the Morse program.



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for this method, as the screen display buffer can be used as the main cell array. No display routine is required because any bit that is high in the screen buffer (location X'0100-10FF) results in a corresponding lighted square on the screen.

In determining the fate of each cell it is necessary to examine portions of bytes above, below, beside, and diagonally adjacent to the byte in question. Thus the new generation can't disturb these bytes until the cell examination is well past. To overcome this problem nine bytes of the new generation are stored in a separate area. As each new byte is formed it is placed in the top of the store and all below are shifted down a notch. The one that comes out the bottom is written back to the screen, nine bytes behind where the cell examinations are actually taking place. A cleared area is required at each end of the cell array to allow for the nine byte difference.

The visual effect of this method is pleasing.

Each new generation wipes onto the screen from top to bottom to replace the old one, much like pulling down a blind. The program running at full speed produces about 80 generations a minute, much too fast to study how each one is formed. So a time delay can be introduced to freeze each generation on the screen. In this mode the program develops 20 generations a minute, or one every three seconds.

You can single-step through the generations at either speed. Assuming the program is stopped, press the 'run' key and hold it down. The computer will beep run one generation, beep again, and stop. You can now release the key and study the generation as long as necessary. Press and hold the 'run' key again for the next generation.

A study of the program listing will reveal that it actually contains two programs. 'Life' itself resides from 0200 to 02AC, and another program called 'Life Loader' from 02AD onwards. Life is written in pure 6800 machine code, with no use made of Chipos subroutines.

There are three ways of getting a start pattern of live cells into the array before the start of a run. The most basic and difficult way, is to plot them out on graph paper, code the live bits into hexadecimal, and then key in full bytes using the DREAM's 'Memod' function.

In the case of a really complicated pattern this may be the most practical method.

Once a starting pattern is set up on the screen, and before it's run, the screen memory (0100 to 0200) can be dumped to tape, and then reloaded again and again via the tape interface. This is very handy for patterns such as the 'thirteen gliders experiment' (Fig.8) where a complex pattern must be set up with no errors. Note that this will only work with the top 3/4 of the screen, as the Chip-8 monitor window wipes out the bottom quarter.

Third method is the one you'll use most often the Life Loader. This program allows you to direct a spot of light around the screen, turning it into a live cell wherever one is required. It also allows control of program speed, full screen erase, and re-starting the main program after it has been interrupted.

Having entered Life and Life Loader into the DREAM, here's how to run them: First, run from address 0200 and any garbage on the screen will begin to undergo changes in accordance with the rules of Life. When the program has just been loaded you must run at least one generation to clear the dead area above the screen. Now press and hold any hex key. When a generation finishes the computer will beep, Life will stop, and a stray dot will appear somewhere on the screen.

The dot can be moved around by pressing 4 for left, 6 for right, 9 for up, and 1 for down. Pressing 5 will cause the dot to disappear as it is recorded as a live cell. Pressing any movement key will cause the dot to re-appear next to the one that's been recorded. If a mistake has been made it can be erased by positioning the dot on top of the offending cell, causing it to disappear. Pressing 5 will kill the cell and cause the spot to re-appear.

To fix a bad mistake press E. This will erase the whole cell array, leaving only the movable dot on the screen. As long as you don't press 5 you can drive the dot right through existing cell patterns with no permanent effect. To set Life to the high speed mode press F (fast). To set it to low speed press C (clow?). To continue the Life run, after modifying the cell pattern or speed, press 3. Thus the Life Loader program lets you set up starting cell patterns, change the running speed, or 'cheat' by inserting or deleting live cells part way through a run.

If the keyboard layout for the movement and enter keys is as shown in Fig.9, you'll soon learn to drive the dot around without looking at the keys. If your keys are in different positions from the layout shown, you can change the key assignments for various functions, as

shown in the table below.

Key for UP	selected at loc. X' 02BA
Key for RIGHT	selected at loc. 02C0
Key for LEFT	selected at loc. 02C6
Key for DOWN	selected at loc. 02CC
Key for ENTER/DELETE	selected at loc. 02D2
Key for FAST	selected at loc. 02D6
Key for SLOW	selected at loc. 02DE
Key for ERASE	selected at loc. 02E7
Key for RUN	selected at loc. 02EE

If your system uses the Digitran keyboard you will need to change two locations; 02BA, which determines the up key, and 02CC (the down key). Simply swap the bytes in these two locations to preserve the same relative key layout as the present program. The functions of the other keys can be left unchanged.

## Life forms

In the game of Life a single cell is doomed from the start, and dies in the first generation from loneliness. Cells in groups are much more interesting. A group of live cells in which members of the group have influence over the fate of the others is called an object. Life objects have been studied intensely since the early days ten years ago, and many learned papers have been written about their behaviour. Many objects have been given high-sounding scientific names, such as 'pentadecathlon' and 'burloferimeter'; others have more descriptive names such as 'toad'.

The objects have been organized into classes, according to their origin and behavior. The simplest, and most common, are called 'Still Lifes'. These are objects in which no births and no deaths occur from generation to generation; seen on the computer screen there is no movement and they are completely dormant. Some common still lifes are shown in Fig.1.

Next come the Oscillators. These change from generation to generation in a cyclic way, repeating themselves in as few as two generations. Others can take as

C	D	E	F
8	9	A	B
4	5	6	7
0	1	2	3

SLOW		ERASE SCREEN	FAST
	↑		
←	ENTER DEL	→	
	↓		RUN

Fig 9: Layout and functions of the keyboard in the Life program presented here.



# Some of the objects of life . . .



Fig. 1: Still Life (A) a block, (B) a tub, (C) a beehive, (D) an aircraft carrier.



Fig. 2: Oscillators (A) a blinder, (B) a beacon, (C) a clock, (D) a toad.



Fig. 3: A block prepares to eat a beehive. Seven generations complete the process. In Fig. 4 a shuttle is shown, flanked by blocks which remove debris that would otherwise destroy it.

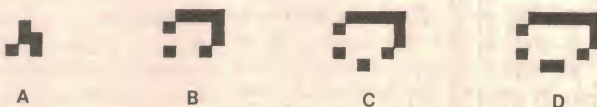


Fig. 5: Space Ships (A) a glider, (B) lightweight, (C) mid-weight, (D) heavyweight version.

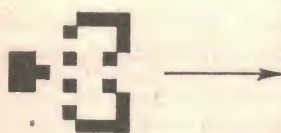


Fig. 6: The Shick Ship Puffer train moves across the screen.

Fig. 7: Below, some random objects. (D) develops into a repeating pattern called "Pulsar CP 48-56-72".

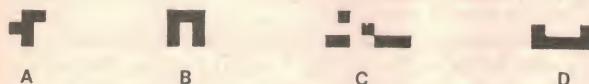


Fig. 8: At right, 13 gliders that form a glider gun.

many as 30 generations to get back to the start. Fig.2 illustrates some of the simpler oscillators. At the end of a Life program run, when it's obvious no further progress is being made, the screen will usually be left with some still lifes and simpler oscillators such as blinkers.

During a run some still lifes appear for a while then sometimes disappear due to their proximity to other still lifes. The ones that survive these confrontations are called 'eaters', they have the ability to chew up another object, spit out the pieces, and then return to their original form as if nothing had happened. The block is the most common eater, it's shown in Fig.3 preparing to eat a beehive.

Some of the more elaborate oscillators can move back and forth across the screen as they reproduce themselves. These are called shuttles. An example is shown in Fig.4.

Spaceships are objects that move continuously in one direction. Examples are in Fig.5. The glider is a particularly interesting spaceship — more on that later.

A puffer train is a moving object that leaves a trail of debris behind it as it makes its way across the screen. The debris is usually short lived. An impressive example is the 'Shick Ship Puffer Train' in Fig.6. Run this one in the high speed mode for full appreciation.

Random objects are those which can-

not be classified as anything else. The objects in Fig.7, although small to begin with quickly grow into populations that nearly fill the screen. The object in 7D, although asymmetrical, grows into a unique period three oscillator called 'PULSAR CP 48-56-72'. The numbers refer to the number of live cells in each of its three forms.

Now, as a grand finale, consider Fig.8. This is a collection of thirteen gliders, and if entered into the computer exactly in the positions shown they'll behave in almost amazing and significant way. When the pattern is run the gliders will begin to move toward each other, with many soon annihilated in a gigantic smash. Just when it looks like the pattern will die the remaining gliders join in and it begins to grow again, eventually forming a device containing two shuttles and two eater blocks. The two shuttles in the resulting 'glider gun' work back and forth, producing a shower of debris every time they collide. The debris then forms another glider which drifts off to the lower right to meet its doom on the lower edge of the screen.

The glider gun represents one of the more significant moments in Life history. Shortly after he invented Life, John Conway conjectured that no finite population of cells grew without limit (in cell numbers) and offered a fifty dollar prize to anyone who could prove him right or

wrong. The glider gun took off the prize for the Artificial Intelligence Group at M.I.T., just a few short months after Conway threw down his challenge.

A study of the gun's operation will show how it won. Remember that thirteen gliders went into its manufacture. After it has produced thirteen gliders of its own everything from there on is pure profit, and there is no reason why a glider gun shouldn't run forever in an infinite cell array. The announcement of the glider gun in Scientific American showed it constructed as an artificial object, ready to start firing gliders.

It's development from thirteen gliders was tacked onto the end of the article, almost as an afterthought.

The above objects can be split into two further categories, the naturals and the artificials. Natural objects are those that occur during the run of a Life program, evolving from other objects. Artificials are those that appear only if specifically constructed by the experimenter as a starting pattern.

But if thirteen gliders can make a glider gun, is it an artificial object? Or is it natural? Is it artificial because the gliders had to be put in the right places to start it off? Could those thirteen gliders have evolved from something else? From thirteen more glider guns? These are only a few of the many questions yet to be resolved in the fascination game of Life!





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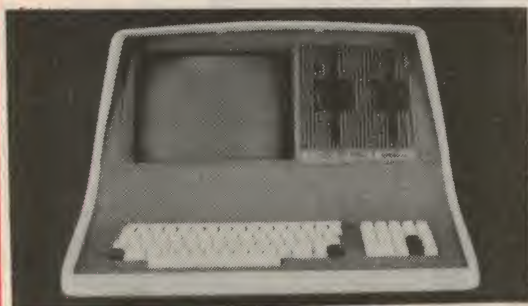
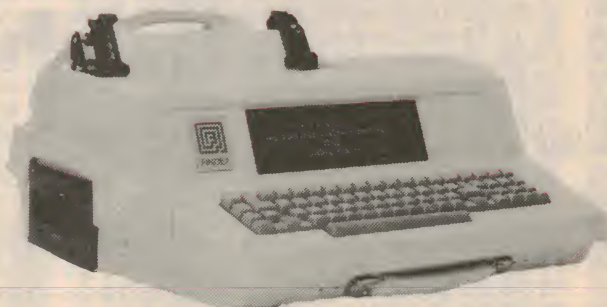
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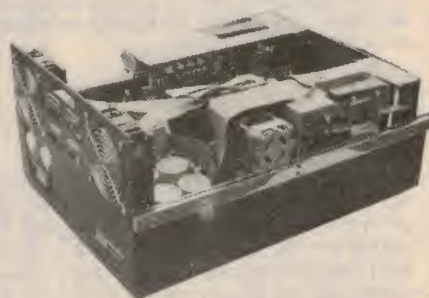
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# DREAM 6800 Programs — the listings

## Space Invaders

```

0200 00 00 6B 04 63 05 6E 0F 66 14 67 19 68 1C 69 00
0210 6D 00 6C 00 65 00 64 00 22 6A 22 56 34 40 22 56
0220 22 76 22 6A 64 10 22 56 34 50 22 56 22 74 45 10
0230 12 14 C9 01 39 00 12 16 22 6A 64 08 22 56 34 48
0240 22 56 22 76 22 6A 64 18 22 56 34 58 22 56 22 74
0250 35 10 12 16 12 14 A2 CE D4 57 74 10 A2 D5 D4 57
0260 CA 08 4A 00 22 8A 74 10 00 EE A2 DC D6 77 A2 B3
0270 D6 81 00 EE 75 01 EE A1 22 B4 E3 A1 76 04 EB A1
0280 76 FC 6F 00 FB 18 00 E0 00 EE 81 50 71 06 A2 B3
0290 71 01 D4 11 31 1D 12 8E 4F 01 22 9E 00 EE A2 AC
02A0 D6 77 F7 18 7D 01 4D 05 22 F0 00 EE 81 42 20 89
02B0 2E 50 BF 08 78 FE A2 B3 D6 81 4F 01 22 E4 38 00
02C0 12 B4 68 1C 00 EE AA 55 AA 55 AA 55 AA 55 18 18
02D0 FF 3C 18 24 24 99 5A 3C 3C 18 24 42 00 00 00 00
02E0 3E 7F 3E 00 A2 C6 D6 59 68 00 F7 18 7C 01 00 EE
02F0 00 E0 A3 10 FC 33 F2 65 F0 29 23 0A F1 29 23 0A
0300 F2 29 23 0A F8 18 F8 18 13 08 D3 75 73 04 00 EE
0310 00 00 04 63 34 E3 A0 93 34 7B 34 5F 34 C7 1C 53
    
```

## Pools numbers

```

0080 80 80 80 80 F8 88 88 88 88 88 F8 80 80 80 F8 88
0090 90 C0 90 88 88 50 20 20 20 F8 88 F8 80 80 F8 88
0200 88 88 F8 F8 80 F8 08 F8 88 C8 A8 98 88 00 00 00
0020 00 E0 61 04 62 02 A0 80 22 42 A0 85 22 42 A0 8A
0210 22 42 A0 8F 22 42 A0 94 22 42 61 04 72 12 A0 99
0220 22 42 A0 9E 22 42 A0 9E 22 42 A0 80 22 42 A0 A3
0230 22 42 71 08 A0 A8 22 42 A0 9E 22 42 A0 A3 22 42
0240 12 52 D1 25 71 06 66 1A F6 15 F6 07 36 00 12 4A
0250 00 EE F0 A0 00 E0 60 00 61 00 62 00 C2 37 42 00
0260 12 5C C3 37 43 00 12 62 93 20 12 62 C4 37 44 00
0270 12 6C 94 20 12 6C 94 30 12 6C C5 37 45 00 12 7A
0280 95 20 12 7A 95 30 12 7A 95 40 12 7A C6 37 46 00
0290 12 8C 96 20 12 8C 96 30 12 8C 96 40 12 8C 96 50
02A0 12 8C C7 37 47 00 12 A2 97 20 12 A2 97 30 12 A2
02B0 97 40 12 A2 97 50 12 A2 97 60 12 A2 C8 37 48 00
02C0 12 BC 98 20 12 BC 98 30 12 BC 98 40 12 BC 98 50
02D0 12 BC 98 60 12 BC 98 70 12 BC C9 37 49 00 12 DA
02E0 99 20 12 DA 99 30 12 DA 99 40 12 DA 99 50 12 DA
02F0 99 60 12 DA 99 70 12 DA 99 80 12 DA CA 37 4A 00
0300 12 FC 9A 20 12 FC 9A 30 12 FC 9A 40 12 FC 9A 50
0310 12 FC 9A 60 12 FC 9A 70 12 FC 9A 80 12 FC 9A 90
0320 12 FC CB 37 4B 00 13 22 9B 20 13 22 9B 30 13 22
0330 9B 40 13 22 9B 50 13 22 9B 60 13 22 9B 70 13 22
0340 9B 80 13 22 9B 90 13 22 9B A0 13 22 C8 37 4C 00
0350 13 4C 9C 20 13 4C 9C 30 13 4C 9C 40 13 4C 9C 50
0360 13 4C 9C 60 13 4C 9C 70 13 4C 9C 80 13 4C 9C 90
0370 13 4C 9C A0 13 4C 9C B0 13 4C 6D 00 6E 02 A0 AD
0380 F2 33 23 D0 A0 B0 F3 33 23 CA A0 B3 F4 33 23 CA
0390 A0 B6 F5 33 23 CA A0 B9 F6 33 23 CA 6D 00 6E 0A
03A0 A0 BC F7 33 23 CA A0 BF F8 33 23 CA A0 C2 F9 33
03B0 23 CA A0 C5 F4 33 23 CA A0 C8 FB 33 23 CA 6D 00
03C0 7E 0A A0 CB FC 33 23 CA 12 52 60 00 61 00 62 00
03D0 F2 65 F1 29 DD E5 7D 04 F2 29 DD E5 7D 08 6F 02
03E0 FF 18 00 EE
    
```

## Tattslotto selector

```

0200 F5 0A 00 E0 66 FA 86 54 3F 01 65 06 75 FF 61 00
0210 80 10 A2 19 F0 55 60 00 A3 00 F0 55 91 50 12 24
0220 71 01 12 10 62 00 22 80 80 20 A2 31 F0 55 80 40
0230 A3 00 F0 55 92 50 12 3C 72 01 12 26 6A 00 6B 00
0240 62 00 80 20 A2 49 F0 55 A3 00 F0 65 67 0A 88 00
0250 69 00 88 75 4F 00 12 5C 79 01 12 52 78 0A F9 29
0260 DA B5 7A 04 F8 29 DA B5 7A 0C 3A 40 12 72 6A 00
0270 7B 08 92 50 12 00 72 01 12 42 00 00 00 00 00 00
0280 87 50 77 01 63 00 C4 FF 61 D8 81 44 4F 01 12 86
0290 74 01 80 30 A2 99 F0 55 A3 00 F0 65 90 40 12 86
02A0 93 70 00 EE 73 01 12 92
    
```

## Morse code trainer

```

0080 88 88 88 F8 88 88 88 88 88 88 70 88 98 A8 C8 A8
0090 70 88 88 88 88 88 70 88 80 70 08 88 70 88 08 30
00A0 40 80 F8 80 80 F8 80 80 F8 80 80 80 80 80 F8
00B0 08 10 20 40 40 40 F0 88 88 88 88 88 F0 88 88 F0
00C0 88 88 F0 A0 90 88 90 A0 C0 A0 90 88 88 C8 A8 98
00D0 88 88 88 A8 A8 D8 88 D8 A8 A8 88 88 88 88 88 50
00E0 20 50 88 88 F8 88 88 50 20 20 20 20 60 20 20 20
00F0 20 70 88 80 80 80 88 70 88 88 88 A8 90 68 00 00
0200 61 08 62 00 63 46 C0 7E 83 05 3F 01 12 04 B2 1E
0210 23 B0 71 08 31 30 12 04 23 B4 00 E0 12 00 12 66
0220 12 6C 12 74 12 7C 12 84 12 8A 12 92 12 9A 12 A0
0230 12 A6 12 AE 12 B6 12 BE 12 C4 12 CA 12 D0 12 D8
0240 12 E0 12 E8 12 EE 12 F4 12 FC 13 04 13 0C 13 14
0250 13 1C 13 24 13 2C 13 34 13 3C 13 44 13 4A 13 52
0260 13 5A 13 62 13 6A 23 98 A0 E0 13 B8 23 9E 23 86
0270 A0 BC 13 B8 23 9E 23 9E A0 F1 13 B8 23 9E 23 88
0280 A0 B6 13 B8 23 88 A0 A2 13 B8 23 86 23 9E A0 A5
0290 13 B8 23 94 23 9E A3 DB 13 B8 23 82 A0 80 13 B8
02A0 23 86 A3 F9 13 B8 23 98 23 92 A3 BC 13 B8 23 9E
02B0 23 94 A0 C5 13 B8 23 98 23 86 A0 A9 13 B8 23 92
02C0 A0 D6 13 B8 23 9E A0 CB 13 B8 23 90 A0 90 13 B8
02D0 23 98 23 9E A3 F0 13 B8 23 92 23 98 A0 F7 13 B8
02E0 23 98 23 88 A0 BF 13 B8 23 84 A0 96 13 B8 23 94
02F0 A3 F8 13 B8 23 88 23 98 A0 84 13 B8 23 86 23 98
0300 A0 DA 13 B8 23 88 23 92 A0 D0 13 B8 23 9E 23 98
0310 A0 DD 13 B8 23 9E 23 92 A0 E5 13 B8 23 92 23 86
0320 A3 C9 13 B8 23 70 23 8E A0 EB 13 B8 23 86 23 90
0330 A0 9C 13 B8 23 84 23 92 A3 CF 13 B8 23 82 23 94
0340 A3 F4 13 B8 23 80 A3 E2 13 B8 23 94 23 82 A3 E9
0350 13 B8 23 92 23 84 A0 AF 13 B8 23 90 23 86 A3 D5
0360 13 B8 23 8E 23 70 A3 C2 13 B8 23 8C A0 8A 13 B8
0370 6C 05 FC 18 23 A4 00 EE 6C 0F FC 18 23 A4 00 EE
0380 23 70 23 70 23 70 23 70 23 70 00 EE 23 78 23 78
0390 23 78 23 78 23 78 00 EE 23 70 23 78 00 EE 23 78
03A0 23 70 00 EE 6B 05 FB 15 FB 07 3B 00 13 A8 00 EE
03B0 6B 0A 13 A6 6B 14 13 A6 D1 27 12 10 08 08 08 08
03C0 08 08 70 88 88 78 08 10 E0 F8 08 10 20 40 80 F8
03D0 08 10 30 08 88 70 88 88 70 88 88 70 88 80 80 98
03E0 88 78 F8 80 F0 08 08 88 70 38 40 80 F0 88 88 70
03F0 F0 88 88 F0 80 80 80 A0 F8 20 20 20 20 20 20 20
    
```

## Life

```

0200 00 00 00 00 00 00 00 4F CE 01 C8 BD C0 7D 4F
0210 CE 00 40 A7 00 08 8C 00 4A 26 F8 CE 00 F7 4F C6
0220 01 09 8D 79 C6 80 08 8D 59 C6 40 8D 54 C6 20 8D
0230 50 C6 10 8D 4C C6 08 8D 48 C6 04 8D 44 C6 02 8D
0240 40 4F C6 80 08 8D 56 09 C6 01 8D 36 96 40 A7 00
0250 DF 12 CE 00 40 A6 01 A7 00 08 8C 00 4A 26 F6 7F
0260 00 49 DE 12 08 8C 02 00 26 B4 C6 74 D7 20 BD C2
0270 97 7D 00 18 27 06 D6 20 26 F2 20 93 BD C2 DF 20
0280 2C 4F 0C 59 8D 17 56 8D 19 56 8D 11 59 81 03 27
0290 07 81 02 27 01 39 E4 09 DA 49 D7 49 39 E5 09 27
02A0 01 4C E5 01 27 01 4C E5 11 27 01 4C 39 8D 45 BD
02B0 C2 C4 36 8D 3F 32 CE 00 2E 81 09 26 02 6A 01 81
02C0 06 26 02 6C 00 81 04 26 02 6A 00 81 01 26 02 6C
02D0 01 81 05 27 DA 81 0F 26 04 C6 01 20 06 81 0C 26
02E0 05 C6 74 F7 02 6B 81 0E 26 03 BD C0 79 81 03 26
02F0 BC 7E 02 0F CE C0 36 C6 01 BD C2 26 7A 00 2F 39
    
```

Well, there it is. Five new uses for the DREAM 6800. Don't forget to put them on tape as soon as you have them up and running, so they'll be ready for future use. All of the programs are entered into memory starting from address 0200. The Morse code program and the Pools program have tables containing character shapes beginning at 0080. The programs are run in the normal way, via the Chip-8 monitor routine at C000, except for Life, as explained earlier.



# Imagine a business computer . . .

If you have a small business, you've probably realised already that a computer would make your business much more efficient.

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Our free April soft and hardware catalogue contains helpful information and all our prices. Here's some:

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# Letters to the editor

## Nuclear reactors — gas or water-cooled?

With reference to your article "What Price the Breeder Reactor", in the March '81 issue.

There are statements made in this article that would appear to me to have been written by someone with insufficient knowledge to adequately translate technical information, or a deliberate attempt to add fuel to the already boiling cauldrons of anti-nuclear or conservation bandwagons.

I refer in particular to the section under the sub-heading "Lightwater slowdown" and I quote: "The neutrons are slowed by a moderator — which turns out to be plain water. The water not only slows the neutrons but also carries the heat from the core to a steam generator which produces electricity".

Pardon the expression, absolute hogwash.

I can only quote facts known, gained whilst servicing equipment in most of the Commercial Power Reactors in the south of England, but:

(a) All were graphite moderated, ie, the fusion producing core is built within a graphite block, the fuel elements one above the other in channels.

(b) Although most of the retarding or slowing of the neutrons is performed by the graphite, the actual total control of the reactor is achieved by absorber rods (boron) more than adequate to shut down any reaction.

(c) Core heat transfer is obtained via carbon dioxide (CO<sub>2</sub>) gas which is forced past the fuel elements, thus maintaining a constant temperature.

(d) The hot CO<sub>2</sub> is then piped to a separate construction where a boiler system, very similar to a conventional power station turns "plain water" (uncontaminated and non irradiated) into steam. This in turn is fed to the turbines which generate the electricity.

To pacify any conservationists who like myself, may have had visions of vast quantities or irradiated, contaminated water finding its way back into the environment, I would like to make one further point. The water used in nuclear power stations is normally very efficiently filtered, not from fear of contamination to the water but because of contamination and erosion of the boilers etc by impurities in the water.

Perhaps I appear from this letter to be pro-nuclear energy or anti-

conservationist; this is not so. I am, however, strongly against inaccurate statements that often stir groups with strong convictions. Whilst recognising the problems of nuclear waste disposal, I cannot convince myself that man's ingenuity will not discover more satisfactory methods of re-use, or disposal, than current technology allows. Also I am not convinced that some of the alternative methods of power production may not have even more drastic long term effects on the environment.

Graham E. Wallington,  
Frankston, Victoria.

**COMMENT: The statements in our article are correct. American nuclear reactors are technically quite different from British reactors, and use ordinary water instead of gas to cool the core. As stated in the article, the water not only transfers heat from the core to a steam generator, but also acts as a moderator.**

**Note also that the article was reprinted from the American magazine "Popular Science" and, as such, is related to the American scene. You are correct in stating, however, that British reactors are gas-cooled and perhaps we should have added a footnote to that effect for Australian readers.**

## Glass bottles — a sign of the times

The article in your February issue, "Glass Bottles with Lights in Them", interested me not only because of the subject matter but also because I regard the publication of such an article by "Electronics Australia" as a sign of the times. Quite frankly I couldn't have seen "EA" devoting a two-page spread to this topic a few years ago. And I have a feeling that it may not be the last time either!

The hobby interest of "vintage" radio is a world-wide one which is growing by leaps and bounds and, as a result, many vintage radio societies have sprung up in recent years. For example, the New Zealand Vintage Radio Society was formed in 1979.

Another indication of the growing interest in this subject is the publication of books in both the USA and Gt Britain dealing with the hobby of collecting and restoring old radios. Already an Australian book — Fin Stewart's "An il-

lustrated History of Philips Radio Valves To 1935" — has recently been published.

Was it just a coincidence, I wonder, that your editorial in the same February issue drew attention to the disappearance of the very factories which produced the receivers illustrated in the article.

Incidentally, the writer of your "Information" section who recommends that the owner of an old Rola electromagnetic speaker use it as a door-stop has yet to realise that this sort of thing would be considered sacrilege by vintage radio collector!

John Stokes,  
Auckland, NZ.

## Negative Ion Generators

Following our recent warnings about a possible ozone emission by some ionisers, Iontech (Australia) Pty Ltd, the company distributing the Ionotron-M units, as advertised on page 31 of our December 1980 issue, has furnished us with a test certificate issued by the Max Planck Institute for Aeronomy of West Germany which indicates that the amount of ozone emitted by the Ionotron (if any) is practically unmeasurable and therefore well within Australian environmental standards.

## Playmaster Mosfet Amplifier

I recently purchased a kit for the Playmaster Mosfet Amplifier and constructed same.

Before commencing construction however, I cut out a section on the underside of the chassis and this has proved invaluable. I am enclosing two photographs, which are self explanatory. It was quite a simple job; however, choosing a suitable material for the cover plate turned out making the chassis stronger and lighter, as I used 16G duralium. This material is light, will not bend, and adds strength to the job. I used nuts and bolts to secure the corners of the PC board, countersunk head, but this was not necessary as the section can be cut out to miss these holes. The cover plate is 10mm larger than the cut-out section.

I tried four self-tapping screws firstly, but settled for eight. There are also two stand-offs in the centre of the cover plate to give further support to the PC board.

I stated before that this innovation proved invaluable, and the reason for this is that I have had to change the BC549 transistors. It was a simple matter to carry out this work. After I had built the amplifier, I noticed that one channel was hissing, whereas the other was not so evident. From various tests it was evident that the trouble was with Q104 and 105, so I decided to remove them





and give them a gain test with a digital multimeter.

Q105 had a gain of 246, and Q104 had a gain of 506. As the gain of these types is rated at 200-800 I decided to purchase 20 of these and give them gain tests. When all tests were complete, I came up with six transistors with the gain figures between 500 and 530. I then replaced the six transistors at Q3, 103, 4, 104, 5

and 105 and this then gave me a very quiet amplifier.

I can honestly say that I have never heard my records, and tapes sounding so fine, and I "dips me lid to ya" for a really great amplifier. All who have heard the results to date have marvelled at the clarity and wish they had one.

David Whitehouse,  
Townsville, Qld.

## Stereo equipment & mains wiring

A line of reasoning which I have held for some time is to isolate mains transformers from metal chassis so that the earth wire can be connected to the transformer casing. This would eliminate the earth connection to metal chassis, the main cause of earth loop hum in hifi equipment, tuners, PA amplifiers, mixers, etc.

In fact, with mains transformers isolated from metal chassis, one could even argue for the adoption of two-wire mains connection. Modern mains transformers are generally of high grade insulation construction which, together with isolation from the chassis, effectively provides "double insulation" and in turn could even eliminate the need for an earth wire. However, in the interests of the highest possible electrical safety a three-core flex could be used as described earlier without causing any earth loop hum problems.

Modern turntables isolate the pick-up (or cartridge) from the metal frame which allows the frame to be earthed without introducing an earth loop from this program source.

Tape recorders and cassette decks are

another problem because motors would require some form of double insulation construction. These units appear to be the only units not capable of being readily adapted to the "double insulation" principle. Some basic redesign of motor mounts, metal drive pulleys and switches would be necessary for these units to attain "double insulation" construction.

I understand some off-on mains switches are virtually double insulated (some pushbutton types), so even these items don't complicate the issue if a manufacturer or hobbyist must incorporate an off-on mains switch on equipment.

Other simple inexpensive aspects of "double insulated" mains transformer and mains cord installation to achieve highest levels of safety might include;

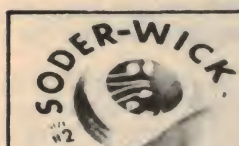
(1) Primary and secondary windings of mains transformers on divided spools rather than layer windings.

(2) Firm and secure mains terminals provided on transformers to eliminate need for flimsy tag strip connectors,

(3) Effective mains cord grommets and securing clips for mains wire entry.

(4) Fuses in the secondary circuit or some other means to isolate gross electrical overload conditions occurring in

(Continued on p150)



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Once upon-a-time there were ...

# Water-driven microphones!

*Following on from our story on gas-powered microphones in the December 1980 issue, the saga continues with the development of water driven microphones. Does your microphone leak?*

by DR CLIVE COOGAN\*

About 70 years ago veritable miniature torrents of water flowed over micro-cascades or mini-waterfalls in the pursuit of the perfect microphone to modulate the new arc and spark radio-telephony. The water-powered microphone stood at the top of the pecking order for some years before finally disappearing over the edge of the waterfall itself.

The great texts of the time, like the "Electricity in the Service of Man" by Mullineux-Walmsley of 1911, or "Telephony Without Wires" by Phillip Coursey of 1919, and the state-of-the-art journals and magazines like "Nature" and "The Electrician" all treated water microphones with the utmost respect. In fact, for a few glorious years, from 1908 to 1914, apparatus using liquid microphones held the world long-distance records for successful telephony broadcasting!

One of the telling points in favour of the water-microphones at that time was that they were capable of dealing with up to 500W of power! In the early spark and arc transmitters, microphones were placed in parallel with the arc and had to deal with large powers if they were to effect an appreciable modulation of the amplitude of the outgoing radio-frequency waves. In fact, all maritime wireless operators were then called "Sparks", a name which has persisted.

The first of the liquid, or as they were sometimes called,

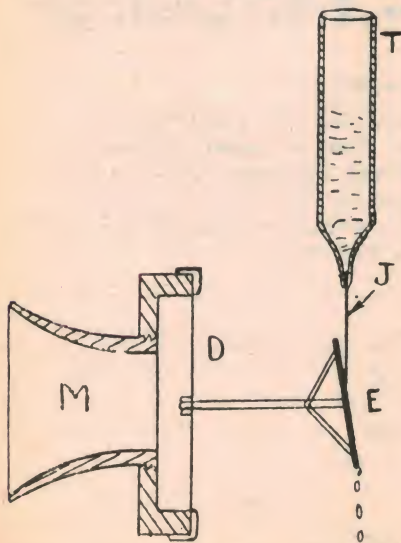


Fig. 1: Jervis-Smith's simple form of variable resistance microphone.



"hydraulic", microphones came "on stream", as one might say, as early as 1879, three years after the introduction of Alexander Graham Bell's telephones, and a good deal prior to the introduction of radio-telephony. Bell's "mouthpiece" of 1876 (the term "microphone" had to await the invention of the carbon microphones by Hughes two years later) was an electromagnetic device identical with the earpiece. The earpiece was marvellously successful and sensitive, but the "mouthpiece" was not able to generate nearly as much audio modulation as might have been desired for long-distance phone calls.

In 1879, Jervis-Smith produced the liquid microphone of Fig. 1. A liquid jet, J, came out of the tube T and struck the inclined plate E, which was attached to the diaphragm D. As the diaphragm vibrated, the length of the jet between tube and plate was varied, and so the resistance of the current path between tube and plate was modulated according to the diaphragm vibration. The liquid was electrolysed by adding soda ( $\text{Na}_2\text{CO}_3$ ) or NaOH (sodium hydroxide) or KOH (potassium hydroxide) to make it a better conductor. And of course the tube had to be refilled by pumping the liquid around the circuit.

The Jervis-Smith microphone illustrated the use of a jet of constant cross-section in which the jet length was varied. Another type which arose in parallel with it was one in which a fixed length of jet path was used but the jet cross-section was modulated by the sound vibrations. This is shown in Fig. 2, and it is easy to see why this finicky device soon died a natural death. It had lots of pivots to stick and go wrong, the needle valve N had to fit smoothly and precisely and there was a lot of inertia to push around.

In both these early cases, as in later electrolytic microphones, only AC could be tolerated, to reduce electrolytic erosion, and the electrodes had also to resist chemical corrosion by the salts in the liquid. For this reason, platinum was the favourite metal.

The successor to this principle was Vanni's liquid microphone. Just as the Italians were very active in early radio in general, they were leaders in the liquid microphone business. Vanni's double-cascade microphone is shown in Fig. 3. Here the jet tumbled from the vibrating electrode A to the fixed electrode B, the length of the path being governed by the vibration of the diaphragm C.

The most popular form of the Vanni microphone is shown in Fig. 4. It is virtually a microphone amplifier (reminiscent of Hortons' gas flame amplifier of the previous article on gas microphones) in which the primary microphone was a con-

\* CSIRO Division of Chemical Physics, Clayton, Victoria.



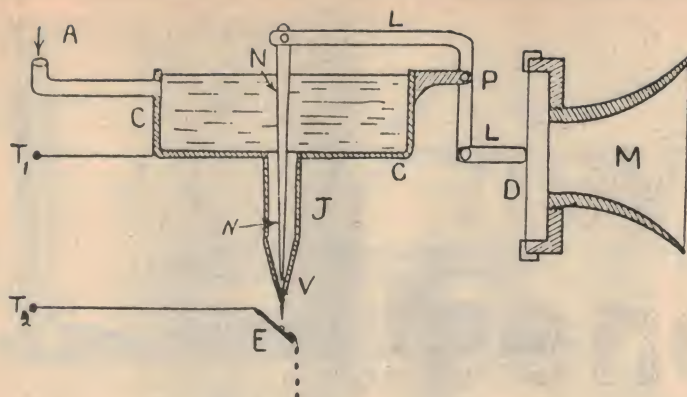


Fig. 2: A variable-jet-width variable-resistance liquid microphone.

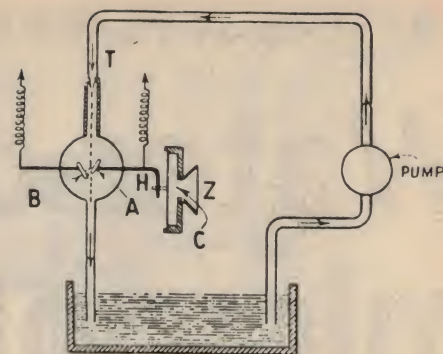


Fig. 3: Vanni's double cascade jet liquid microphone.

Fig. 4: Vanni's liquid microphone working as an amplifier for a carbon microphone.

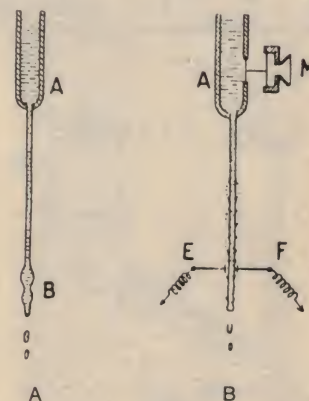
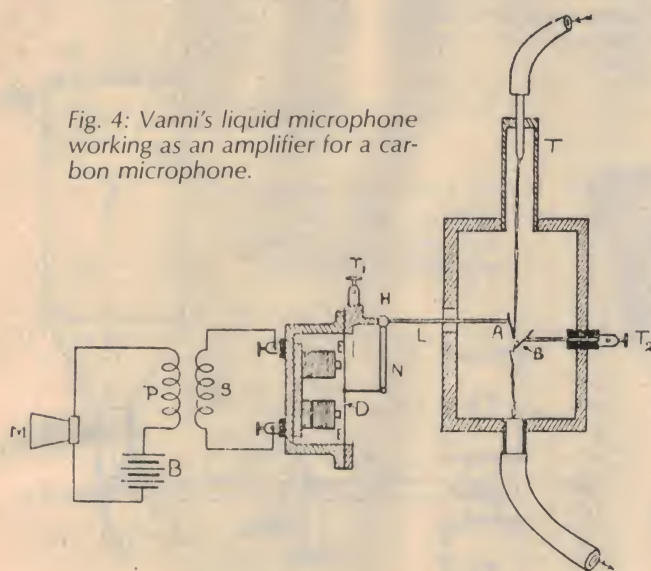


Fig. 5: (a) the Bell effect. (b) Majorana's liquid microphone using the Bell effect and voice-modulated pressure.

ventional carbon microphone which was used to vibrate a diaphragm D and hence vary the double-tumble path between A and B.

Microphones of this type were used successfully to control antenna currents of up to 15 amps! With this type of apparatus, Vanni obtained a speech range of 960km between Rome and Tripoli in 1912.

A quite different type of effect arose from experiments which Lord Rayleigh did in the Cavendish Laboratory in Cambridge in 1879. Rayleigh studied the way in which water jets broke up into drops under the effects of vibrations, electricity, etc. Many useful things originated in this "curiosity-oriented" research, including modern computer "jet-printers", biological cell sorting, atomization of liquids, and very recently a wind driven electrical generator, besides one of the types of liquid microphone.

Alexander Graham Bell was not the only bright star in the Bell family. The Scot had enlisted his English cousin, Chichester Bell, to run the forerunner of the Bell Telephone Company's giant research laboratory at Murray Hill. Following Rayleigh, Chichester Bell observed that sound waves made a significant difference to the way in which a jet formed isolated beads a little down stream from the jet orifice. This is known as the Bell Effect. His apparatus is shown in Fig. 5, together with the way in which Majorana, another Italian, developed it into a microphone.

As can be seen in the sketch, the voice modulated the hydrostatic pressure in the tube and "wiggled" the beads up and down at the point in the jet stream where they were forming, thus varying the area of contact between the electrodes. Majorana also developed a "microphone amplifier" version,

operating on a variant of the Bell principle, shown in Fig. 6. The flexible tube T is vibrated transversely, thus varying the contact overlap between the electrodes T<sub>1</sub> and T<sub>2</sub>. In 1906, using his liquid microphone, Majorana transmitted from Rome to Sicily, about 500km.

Another successful type was Chambers' liquid microphone (1910) shown in Fig. 7, which has a complicated relationship to both the microphones of Majorana and of Vanni. In this case a jet of acidulated water pumped through C hit the vibrating diaphragm D, and the jet length, width and general conformation were all varied by the position of the diaphragm, and so the resistance between T<sub>1</sub> and T<sub>2</sub> was modulated. It could handle 400W and was highly regarded because it was so well damped (sic!) and did not exhibit distorting resonances.

Incidentally, the rate of flow was throttled until the outflowing liquid reached 80°C, which might give a clue to the origin of the term "hot" microphone!

Yet another clever principle was used to modulate not the length or breadth of the jet, or the position of formulation of "beads", but to vary the actual conductivity of the electrolyte itself. This type, invented by Sykes and Ford in 1914, and known as the Sykes liquid microphone, is shown in Fig. 8.

The liquid in the tube X is pure water (a poor conductor) which flows in orderly stream-line due to the anti-splash glass fibre filter A. The tube T contains a strong electrolyte, the amount of which emerging into the flow of tube X depends on the pressure modulation exerted by the diaphragm D. Thus the resistance between B and B<sub>1</sub>, a finite phase lag down the line, was governed by the vibrations of the diaphragm.

Contrary to what one might dream up about liquid diffusion, and other horrific complicating factors, the microphone was



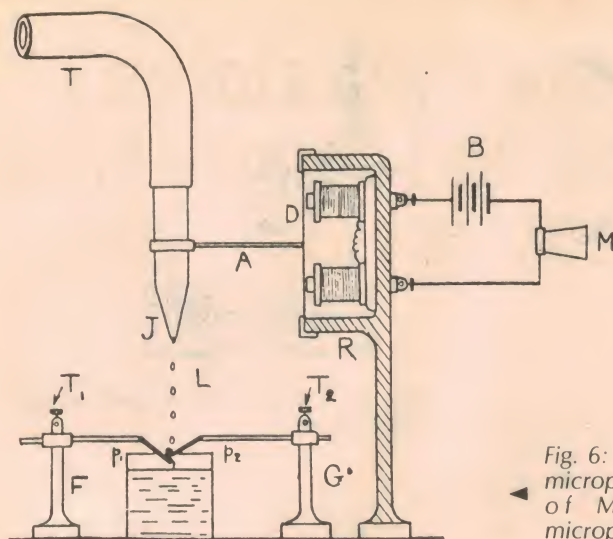


Fig. 6: The transverse vibration microphone amplifier version of Majorana's liquid microphone.

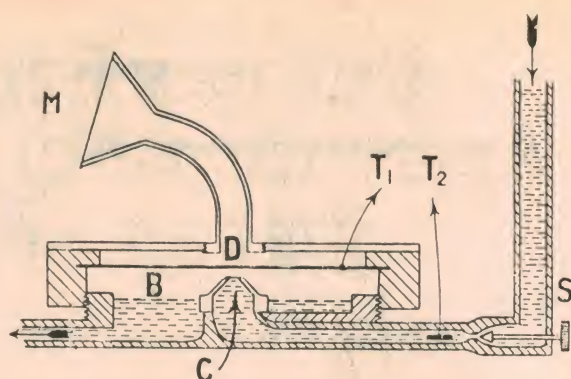


Fig. 7: Chamber's liquid microphone.

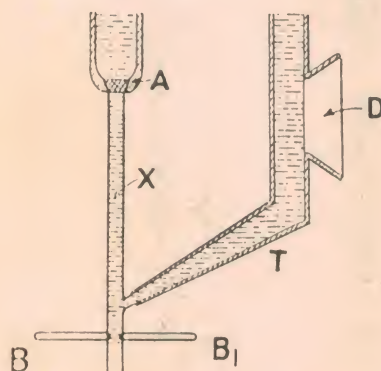


Fig. 8: Sykes and Ford's liquid microphone with modulated electrolyte injection.

Fig. 9: Dublier's multiple carbon microphone with six heads.

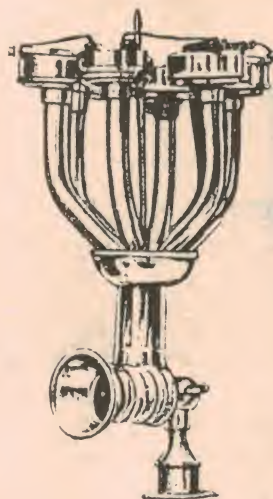
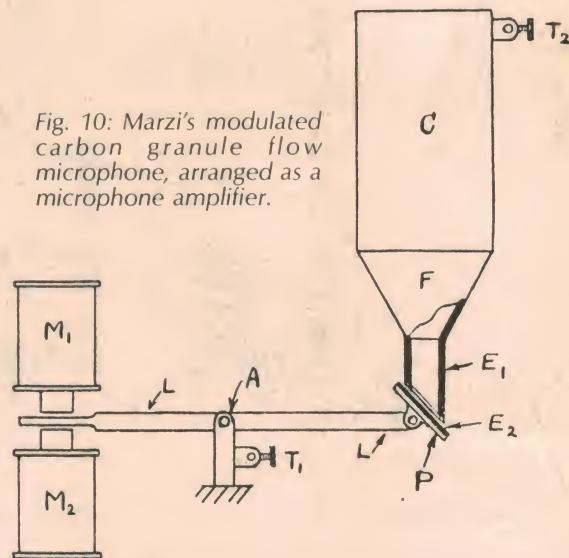


Fig. 10: Marzi's modulated carbon granule flow microphone, arranged as a microphone amplifier.



highly regarded as it could handle high power and rendered excellent fidelity.

Liquid microphones were asserting ascendancy over carbon microphones due to their better power-handling abilities, as the carbon granules tended to sinter together when hot. Several attempts were made to overcome this defect. As mentioned in the previous article, Dublier developed a water-cooled carbon microphone capable of handling up to 750W. Dublier also developed a Medusa-like multiple carbon microphone, with six microphones fed by a single mouthpiece. Fig. 9 shows this plumber's nightmare.

About 1910 Marzi invented a carbon granule microphone which was analogous to the liquid microphones and could deal with large currents. This is shown in Fig. 10. Once again it is really a microphone amplifier, as the coils  $M_1$  and  $M_2$  needed to be fed by a conventional carbon microphone and the resultant motion of the electrode  $E_2$  varies the distance between it and the fixed electrode  $E_1$ , between which the carbon granules stream from the hopper C. The variation in the distance between  $E_1$  and  $E_2$  modulates the current between them. Announcers emerging from the studio must have resembled the late shift from a coalmine!

In parallel with these liquid microphones myriads of electrolytic receivers, relays and amplifiers sprang up. Some, for example, used the rectifying properties of the "double-layers" at the surface of metallic electrodes, and others made use of the apparent change of surface tension of a mercury drop in dilute sulphuric acid when there is a small potential difference

between the mercury and the acid.

When the triode valve became established, it swept away the arc oscillators and with them the need for high-power microphones. Thus the carbon microphones came back into favour and the liquid microphones disappeared. It was not that better microphones swept them from the scene but that the requirements for microphones changed dramatically.

No account of these jet devices is complete without a brief description of an allied device invented by Alexander Graham Bell to act as a light modulating voice transducer. He came up with it at the time of his intense work on his "photophone" which started in 1880, and used it to make what was undoubtedly the first photo-recorded speech track on a glass photo plate using a circular track. For details of the device I am indebted to Dr Elliot Sivowitch of the Smithsonian Institution in Washington, who also sent me a tape recording of the sound from this strange track. I make it out to say "oomph woof" — some claim to discern actual human words!

Bell used a jet of black ink impinging on a window through which a focused beam of light passed. As in the liquid microphones the jet was modulated by sound vibrations, and thus the light transmission was also modulated.

Of course there were many other peculiar microphones: carbon, liquid and gas by no means exhausts the list. For example the hot wire microphone once looked promising. But let these be decently interred. If both readers and editor permit, I might later outline a few of the fascinating early attempts at earphones and loudspeakers.



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# AMATEUR RADIO

by Pierce Healy, VK2APQ



## Canberra rejects pensioner licence fee concession

Reply to WIA on licence fee concession; HIDXA expedition postponed; Radio Old Timers Club; WICEN; a new award; and items on several aspects of amateur radio are in this month's notes.

After five years the Wireless Institute of Australia has received a final ruling from the Federal Government concerning a reduction in amateur licence fees for pensioners eligible for "fringe benefits". The letter, dated March, 4 1981, from the Minister for Communications reads:

"You recently asked for clarification of the Government's attitude on the subject of concession fees on amateur radio licences for pensioners eligible for fringe benefits.

"In 1976, the then Minister for Post and Telecommunications, the late Hon E. L. Robinson, indicated his agreement in principle to the proposed concession on the understanding that the impact on revenue would not be significant, and drafting of a regulation was commenced.

"However, when the draft regulation was subsequently submitted to Mr Robinson's successor, the Hon A. A. Staley, the situation had changed. The citizen's Band Radio Service had been introduced and there was a real question whether the concession could be confined to amateurs, without extension to pensioners operating citizen band, harbour mobile, or other classes of radio equipment.

"You will appreciate that this raised the prospect of revenue implications far greater than those associated with a concession restricted to amateurs. Consequently, the matter was referred to the Departments of Finance and Social Security for advice of the implications for general finance and welfare policy.

"The response revealed that the proposed concession would not be consistent with Government policy which generally restricts fringe benefits to charges such as telephone rental or medical treatment, both of which are regarded as essential for the health and welfare of pensioners. Recreational activities, such as amateur radio, while recognised as very valuable to pensioners, are not regarded as a suitable area for the extension of fringe benefits.

"A concession to pensioner amateurs would represent a new departure in

Government policy, and similar benefits could scarcely be denied to pensioners using other types of radio equipment. Consequently, I regret that the Government is no longer able to proceed with the proposed concession".

### BITS AND PIECES

A circular has been received from Germany listing a number of publications which identify utility radio stations and their transmission modes.

Under the heading "Some remarks for radio amateurs, or newcomers to the utility-DX hobby" was the following comment: "The shortwave range goes from 3MHz to 30MHz and is divided into separate sections. The allocation to amateur radio stations covers about 2.9MHz or 10.7%, international broadcasting about 2.35MHz or 8.7%. Consequently, more than 80% remains for the utility services.

"Although many countries and stations violate this distribution, by far the greatest part of the SW range is actually covered by utility stations. These belong to various services: aeronautical, fixed, maritime, mobile standard frequency service etc."

It goes on to list the type of stations that operate within these services, and the type of modulation used.

Reference is also made to the availability of modern receivers with continuous coverage of the SW band and the interest in utility-DX hobby, qualified by the statement: "Unfortunately, the reception of utility stations is not allowed by most national telecommunication administrations."

Among the publications listed are: "Call sign list of Utility Stations"—More than 6400 call signs in alphanumeric order; "List of Radioteletype Stations in Frequency Order"—More than 1200 frequencies of stations which have been logged 1979-1980, with frequency, call sign, and name of station.

It was mentioned that the latter publication would be of interest to amateurs who operate radioteletype. The prices given were DM17.00 or 24

IRC's and DM25.00 or 36 IRC's respectively, including surface mail. Enquiries to Joerg Klingenfuss, Panoramastrasse 81, Hagelloch, D-7000 Tuebingen 7. Federal Republic Germany.

**LIECHTENSTEIN DX-PEDITION:** From June 15, 1981, for about seven days, Roger KA2JFY/HB0 will be looking for SSB contacts on all bands from Liechtenstein in Europe.

His equipment will be an FT101ZD and a five-band trap vertical antenna. He will be looking for VK contacts around 28.400MHz.

Roger also operates under the reciprocal call sign DA2CK from Bitburg in South West Germany.

### WICEN ACTIVITY

Over the last weekend in March 1981, members of the NSW WICEN organisation participated in two well publicised events, providing communication facilities. The organisers of both events expressed their appreciation and it is understood have asked for similar assistance next year.

Members of the Sydney West region WICEN, assisted by members from other areas, provided comprehensive communication facilities at the Schofields Air Show. Members of the Sydney South region gave their services at the Surf Championship Carnival held at Wanda Beach.

The Wireless Institute Civil Emergency Net is a voluntary organisation of amateur radio operators trained and coordinated to provide communication assistance in times of emergencies. Participation in events such as mentioned above are provided for in regulations as training exercises.

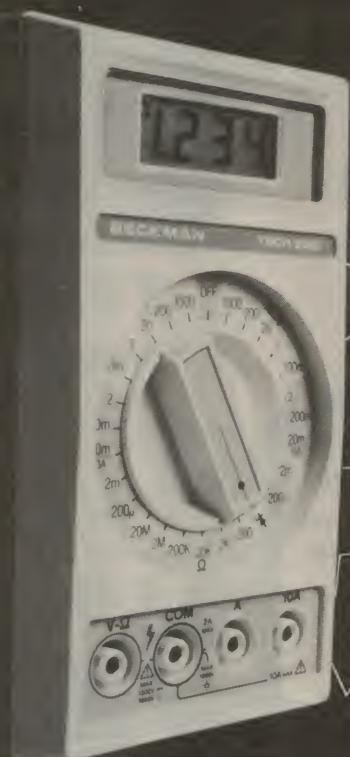
### HIDXA PROJECT

**HEARD ISLAND DX ASSOCIATION:** A letter from Jim Smith, organiser of HIDXA, in which he expressed his disappointment at the cancellation of the proposed DX-pedition this season, and gave some information on future project activities.

It appears that the shipping company considered it too late in the season, with too short a time slot when weather conditions would allow a trip to Heard Island. However, steps are being taken to confirm a proposed departure date next season.



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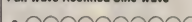
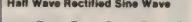
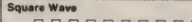
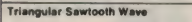
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Square Wave 0 	1.110V	1.000V	1.000V
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# AMATEUR RADIO

It has been confirmed with Government offices in Canberra that all previous correspondence, telephone calls, and visits remain as is and the provisional permission granted will be forthcoming again. The licence for the call sign, VKOJS, will be renewed when it falls due (May 1981).

There were 256 donations made to the HIDXA and all parties were mailed receipts. In addition many sent the odd dollar to help out, but due to obvious reasons it was impracticable to acknowledge these by receipt. Refunds of donations will be made if requested.

The letter concludes - "... if nothing else has been achieved, the mechanism has been set up for any well meaning, well organised, party to go to Heard Island with governmental blessing ..."

Also, please note Jim's change of address and call sign: J. B. Smith, VK9NS PO Box 103, Norfolk Island, Australia 2899.

INDAMSAT: This may be a word appearing in future amateur publications. Following the successful launching into space of India's first fully indigenous satellite, Rohini-1, from a small coastal island near Madras, there is now a possibility of Indian amateurs building their own OSCAR type satellite.

This possibility has been expressed by M. V. Chauhan, VU2MV, editor of "RADIO" journal of the Federation of Amateur Radio Societies of India, (Sept 1980)

The four stage SLV-3 rocket which carried the satellite into a 950km maximum and 325km minimum orbit was launched on Friday July 18, 1980. It is understood several Indian amateurs, including V. P. Sandlas, VU2VP, were associated with the Indian Space Research Organisation. TRANSMITTER TUNE-UP: A variety of devices to aid blind amateur operators to tune their transmitters have been devised, usually converting visual indications to audio tones. An interesting approach to provide such a facility is given in an article by James D. Burney, WA4LBX appearing in "73 Magazine" January 1981.

This audible tuning aid operates on the assumption that maximum power transfer from the transmitter to the antenna will occur when the transmitter is properly tuned. RF power is sampled by inserting a coupler in the feed line. The output of the coupler is fed to a voltage-to-frequency converter.

The converter uses a 555 timer IC in a configuration which, when the input voltage is varied as the transmitter is tun-

ed gives a varying tone from a speaker. RTTY TERMINAL UNIT: An article under this heading appears in QST for December 1980. It uses two ICs: an XR-2206 function generator and an XR-2211 FSK demodulator. The author, Michael J. Di Julio, WB2, claims the device works well and is suitable for interface with the loop supply of mechanical teleprinter equipment.

HOMEMADE QSL CARDS: This project could interest those with an artistic flare or the desire for a personalised card at low cost. According to the author, Alexander B. Murphy, WB3IRV/HL9V1, it can be done successfully using a silk screen hobby kit. Details in QST December, 1980.

## RADIO CLUB NEWS

THE NORTH WEST RADIO SOCIETY: This club was formed at the end of 1979 to cater for amateurs living and working in the north west of Western Australia. Over the past 18 months members have been spread as far afield as Kununurra, Koolan Island, Port Hedland, Karratha and Newman. A chapter was formed at Newman in 1980.

Most of the club's activities have been organised in the Port Hedland area. Members have been involved in assistance to civil authorities during cyclone emergencies, construction of club station and antennas, organisation of the North West Award, and participation in the Jamboree on the Air and Remembrance Day Contest.

Meetings are held on the first Friday of each month at the club house, Mt. Newman Rail Welding yard. Nets are conducted at 1200UTC Thursday and Sunday on 3605kHz and 28.445MHz under the call sign VK6ANW. Repeater VK6RNW on channel 7000 (old Ch 8) is expected to be in operation mid 1981. NORTH WEST AWARD The purpose of the award is to promote interest by Australian and overseas amateurs and short-wave listeners in contacting amateurs in the north west region of Western Australia and to promote amateur radio activity within the area. The north west region is defined as that area north of the 26th south parallel.

Rules and conditions; only contacts made from outside the north west area after January 1, 1980 will count and an extract from the log countersigned by two other licensed operators is to be provided.

HF AWARD: The applicant must contact at least one of the club stations VK6MN in Newman or VKANW at Port Hedland plus any other amateur operators within the designated north west area, as follows: 6 contacts on three or more bands; 8 contacts on two bands; 10 contacts on one band.

Contacts must be with operators from

at least three different locations within the north west and over a minimum period of 48 hours from the first to the last contact.

VHF AWARD: The applicant must contact three north west stations in at least two different locations over a minimum period of 24 hours on any authorised band above 30MHz.

SWL AWARD: The applicant must submit a countersigned extract from their log for either HF or VHF contacts made according to the conditions detailed above.



Cost of the Award: VK call area operators \$1.50; Overseas operators \$2.50.

Applications to be sent to Awards Manager, PO Box 283, Port Headland WA 6721.

COFFS HARBOUR & DISTRICT AMATEUR RADIO CLUB: Meets each Wednesday evening at 7.00pm (with the exception of school holidays) at the Orara High School, Bray Street, Coffs Harbour. Novice and AOCB classes are held at these meetings with a business meeting and lecture or film on the third Wednesday of the month.

A club net is held each Monday evening at 8.00pm on 3610kHz. Participants other than club members are invited to join the net. A VHF repeater is being constructed and operation on channel 6650 (old channel 1) has been approved.

Slow Morse practice sessions are conducted on air on behalf of the club by Harry Alderson, VK2EP, morning and evening for several weeks prior to examination dates, on 3550kHz.

Postal address is PO Box 655, Coffs Harbour, NSW 2450.

## SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.

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**THE COURSE SUPERVISOR,  
W.I.A.**

P.O. BOX 123,  
ST. LEONARDS, NSW 2065

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.



# The Australian CB SCENE



## "Pull over driver!" Has this happened to you?

One would have hoped that the days had passed of mobile CBers being picked on by the police. Such is not the case, if a recent incident in Brisbane is to be taken as a criterion.

Two friends of mine, Harry and Peter, were mobile in the wee hours of the morning when they were pulled over by a police car. The car was checked for road-worthiness, and a couple of defects were noted. During the course of the inspection, the policemen also asked questions in relation to the CB set which was in the car.

The officers stated that the licence number must be on the car and/or the set, that 23 channel sets are illegal, and that a CBer must carry his licence with him at all times. Harry and Peter tried to set the officers straight on the subject but to no avail. They were told to disconnect the set immediately. Not being in any position to argue the matter further, they did so.

The fact is that the licence number no longer has to be displayed on either the vehicle or the set. Nor is an operator any longer required to carry his licence with him (due to the introduction of multiple licensing) but he/she is required to know the licence number. The licence must also be produced within a reasonable time if the operator is required to do so.

Most likely, the confusion over the legality of operating a 23 channel set has come about by the wording of a press release issued by the Minister, Mr Sinclair, in the latter part of March. It stated that changes had been made to the Customs Act which will prevent the importation of equipment which is not fitted with 18 channels. However, the restriction does not apply to 23 channel sets already licensed and in operation.

I lead with this story, this month, for the sake of licensed CBers, who aren't too sure of the regulations, and who might be constrained to hand over their equipment to a police officer without good reason. In fact, a copy of RB14 and RB14A are handy things to carry in the glove box in case of just such an eventuality.

In my capacity of National Liaison Officer for the NCRA, I have taken up the issue with the Minister for the Department of Communications, the Queensland Branch of the Radio Fre-

quency Management Division and also the Queensland Police Department. I would like to hear from anyone else who has had a similar experience.

### AACBRO and NCRA

Mr Brian Groves, of the Australian Association of Citizens and Band Radio Operators Inc has commented on an article I did for the December 1980 issue of EA. In that article I said: "... it appeared for a while that another National CB organisation was on the move, in the form of the Australian Association of Citizens and Band Radio Operators, based in South Australia. This caused considerable comment. Indeed, it is always good to see any initiative which might help push the cause of the CB operators. However, further information would suggest that it was a fairly tentative move I sincerely hope that this is not the case, and would extend the invitation to anyone associated with the group to contact me with more information."

Unfortunately, Brian seems to have read more into the comment than was actually there. Let me explain:

When AACBRO was first formed, I heard a great deal about it: how it was to be run, its aims and objectives and so on. Since then, however, I have heard nothing more and had gained the impression that it was no longer active. It is good to hear from AACBRO again and to learn that it is still going strong.

I am most anxious to avoid the impres-

sion that, because I am associated with the NCRA, I will not give due weight to information from other organisations. That is not the case and I try sincerely to be impartial.

Speaking personally, and as a member of the organisation, I can say that the NCRA is quite willing to work in with any other group which can show itself to be serious and dedicated to the improving of the conditions under which we all operate. A brief history on what the NCRA has been up to since last May (1980) is as follows:

MAY — Submission to the Inquiry into the CBRS.

NOV — Submission on the results of the Interim Report into the CBRS.

JAN — Submission on the Proposed Table of Australian Frequencies.

FEB — Submission on the draft proposals of the Radiocommunications Bill (1981).

MARCH — National Director attended the Radiocommunications Bill meeting in Canberra.

APRIL — Submission for an increase in the allocation of money to the Radio Frequency Management Division of the Dept of Communications.

Just to round this off, I would like to quote from Brian's letter:

"... Let me assure all readers that AACBRO, like any other Association, has had setbacks, but these I can confidently report have been overcome by the committee and members and we look forward to some very healthy progress to aid the CBRS in 1981. According to feedback to our Association it would seem that in the opinion of most of the CB operators the fight is over because of the statements released in the press prior to the last Federal elections. AACBRO believes that this is not the case. Where are our better operating conditions? Surely CBRS users do not believe that they yet have a usable and understandable set of operating conditions, adequate policing of the service, enough HF channels to operate on, etc. For these reasons alone AACBRO still needs to continue to function, and function I assure you we are."

In saying cheerio for yet another month, may I mention that Jan is short for Janette. Yes, I am a member of the "fairer sex".

**Jan Christensen**

### OLBIS/EA CONTEST

Don't forget that June 30 is the closing date for the CB competition conducted through these columns and sponsored by Olbis Industries of 2164 Ipswich Rd, Oxley, Qld. Prizes are Contact PSC-301 SSB rig with antenna, and a Ferguson SSB power supply. Entrants should explain in 250 words, or less: "Why I took up CB, and what it means to me now". For more complete details see the April '81 issue.



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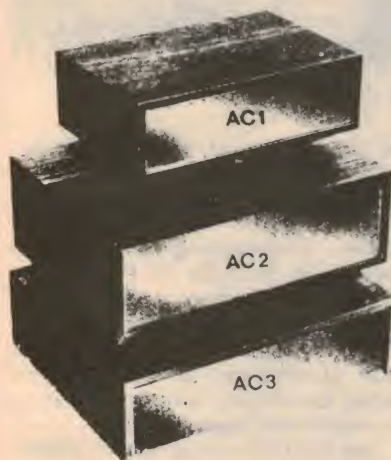
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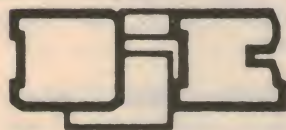
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# SHORTWAVE SCENE



by Arthur Cushen, MBE

## Radio Dubai to offer extensive world coverage

The recent testing of Radio Dubai's three 300kW transmitters has resulted in reports from all over the world. The station is gradually moving towards an External Service which will operate between 0230 and 2100UTC as soon as new studio buildings are completed in Dubai.

The broadcasts of Radio Dubai have been varied and signals have been observed on most of the higher frequency bands during the period of testing before regular broadcasting commences. Radio Dubai transmits from a new site 32km inland in an area where sandstorms are not prevalent — the dust can cause transmitter failure. The three transmitters are of 300kW and the building has provisions to house a further unit.

The antenna system consists of 15 arrays giving transmissions to South East Asia, Europe and North America. The power supply is fed from the main supply in Dubai.

English broadcasts at present are heard with news at 0330, 0530, and 1030UTC and these are taken from the English program which is carried on FM. The station expects to operate from 0230 to 2100UTC daily as soon as a new studio complex is completed in Dubai.

There has been world wide interest in the station and tape recordings, letters and other information from listeners is received at the rate of 100 items a day.

The chief Engineer, Harold Robins, in a recent interview on Radio Nederland, stated that the medium-wave outlets were also received at distant points, and said that the Arabic transmission on 1481kHz using 1300kW was often received in New Zealand. The English program on 1251kHz with 600kW has been widely reported from Northern Europe.

The present schedule is 0230-2050UTC and there are three sections in English with news at 0330-0355UTC on 9640, 11755 and 15320kHz; 0530-0545UTC on 11940, 1775 and 17810kHz; and 1030-1040UTC on 17775, 21640, 21700 and 21695kHz. The balance of the program is in Arabic and other frequencies

have been heard on a test basis, including 9505kHz which has been used at 0330UTC for the English broadcast.

The address of the station is External Service, Radio Dubai, PO Box 1695, Dubai, United Arab Emirates.

### 3RPH ON AIR

The Melbourne station, 3RPH (Radio for the Print Handicapped), commenced test broadcasts in early April and is now operating regularly on 1705kHz with 500W. This station is the first of three scheduled to operate on frequencies outside the medium-wave band, the other two being located in Sydney and Hobart.

The initial broadcast detailed radio and television programs for the next day, and carried editorial reviews from the Melbourne Papers.

Radio Print Handicapped has studios at 7 Donald Street, Prahran, Melbourne 3181, and the transmitter is located at Collingwood. The first test broadcast was well received in New Zealand around 1130UTC and the frequency should provide good coverage after dark throughout most of the Eastern States of Australia and New Zealand.

### AUSTRIAN SCHEDULE

Broadcasts from Vienna for our winter reception period are now being transmitted on some new frequencies. The broadcasts to Australia and New Zealand and South East Asia are from 0400-1300UTC. The transmission 0400-0600UTC is on 17745kHz; 0600-0900 21500 and 21640kHz; 0900-1100 21660kHz; 1100-1300 on 21610kHz. English is broadcast 0430-0500 and 0830-0900UTC. The frequency of 21610kHz could be changed as this causes interference to Radio Sweden broadcasting to Australia 1100-1130UTC also on 21610kHz.

Other changes include broadcasts to Europe 2000-2200UTC on 9615kHz replacing 9755kHz, and to West Africa 1900-2100UTC on 15125kHz replacing 12015kHz.

### ANNOUNCING IN JAPAN



Barry Seeber

One of the familiar voices on Radio Australia has been Barry Seeber who is now heard from Radio Japan. Barry Seeber has been working with the Australian Broadcasting Commission through Radio Australia for the past 10 years and is spending a year at the English section of Radio Japan. In addition to reading news on Radio Japan's General & Regional services and introducing the weekly Editorial Roundup, he is contributing regularly to the Saturday magazine program "Hello Australasia".

Radio Japan broadcasts to Australia daily 0930-1030UTC on 11875 and 15235kHz.

### SIGNALS FROM GABON

Radio France International is now using the transmitters of Africa Number One for relays of their program to Africa. Two frequencies have been observed, 11810 and 15435kHz, with the latter frequency giving the best reception. All broadcasts are in French and the station was heard closing at 2130UTC with the French National Anthem, but now appears to close at 2100UTC.

The program is all in French and it has been noted that the familiar orchestral news theme used by Paris for many years has been changed and this new theme is played before all news bulletins. Signals have been received on 15435kHz from around 1830UTC to sign-off with light co-channel interference from a weaker station.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.



## ENGLISH FROM MOZAMBIQUE

Radio Mozambique's External Service has been operating for more than a year from Maputo and, according to the BBC Monitoring Service, broadcasts are well received throughout southern Africa. The station carries three English broadcasts a day and since January, 1980 has increased its audience in the southern Africa area with news bulletins at 0400, 1100 and 1800UTC. The broadcasts at 0400 and 1800UTC have been heard on 3265 and 4855kHz and at 1100UTC on 9600 and 11820kHz.

## COOK ISLAND MOVES

Radio Cook Island at Raratonga has made a frequency change to 9695kHz from 5045kHz. The broadcast is received around 0700UTC up to sign-off at 0900UTC. John Mainland of Wellington reports receptions of the new frequency, while our observations show that on Sundays there is a telephone request program with the name of the program being "100 M", which is conducted in Raratongan. Though signals are stronger than on 5045kHz, interference on the new frequency is rather severe towards 0900UTC.

After a period of testing on 9695, Raratonga then moved to 11760kHz and was heard closing at 0900UTC with a much clearer signal free from interference. This frequency change has proved to be the better of the two channels tried and it is presumed that 11760kHz could be a permanent replacement for 5045kHz.

## 35 YEARS OF FEN

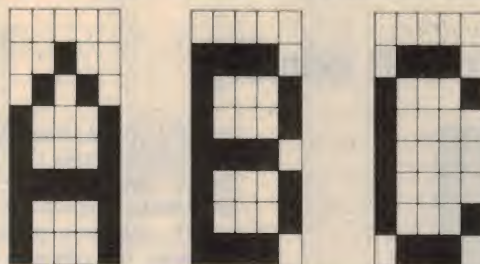
The Far East Network, operated by the American Forces in Japan, has recently celebrated 35 years of broadcasting to an estimated 23 million listeners throughout Japan. Most of these are not American servicemen but young Japanese keen to hear popular programs and improve their knowledge of the English language.

It was during the war years that the United States established Armed Forces radio stations in the South Pacific in Auckland, Noumea the Solomons, New Guinea and the Philippines and, at the end of hostilities, in Japan. Today the network operates from eight stations in the Western Pacific, including a multimillion dollar computerised studio at Yokota Air Base on Tokyo's western outskirts. But the mission remains much the same.

FEN tries to steer clear of propaganda and the network makes a policy of broadcasting nothing that would offend the host country. The station presents news in a unbiased manner.

The shortwave transmissions are frequently heard in Australia with the broadcast on 6155kHz being received around 1000UTC and later on 3910kHz, the transmission actually running 24 hours a day. Other frequencies in use are 11750 and 15260kHz.

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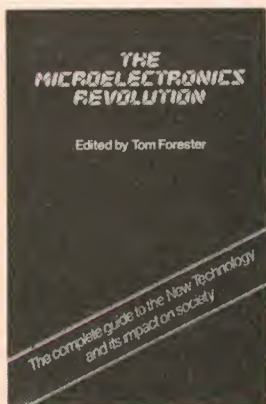
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# Books & Literature

## Electronics and society



**THE MICROELECTRONICS REVOLUTION**, Tom Forester (ed). First Edition, Soft covers, 608 pages, 237mm x 156mm, illustrated. Published by Basil Blackwell 1980. Price \$17.50.

What does microelectronic technology mean for our society? Does the future hold a computerised 1984, or will it be a new era of freedom and prosperity based on the power and versatility of the silicon chip? Where are we going, and will we like it when we get there?

These are just some of the questions raised by the ever-widening use of computers and automation made possible by the microprocessor. Some have called it the Third Industrial Revolution, with computers seemingly poised to take over functions previously considered the exclusive domain of thinking human beings. The economic effect of increased productivity and reduced labour needs is the most visible consequence of the "microelectronic revolution" but there are also more subtle questions to be considered. Will the ready availability of information produce more powerful, responsible individuals, or increase the likelihood of social manipulation through control of information? What are the political effects of cheap computers and mass communication? Last, but perhaps most important, what will be the impact of increasing use of computers on our concepts of the human personality and the potentials and limitations of human beings?

"The Microelectronics Revolution" is a comprehensive set of readings covering all aspects of microprocessor technology

and the social changes it will bring. Over 40 authors from the United States and Britain deal with the issues, describing the new technology and the forces which created it, analysing its impact on industry, the office and the home. Both sides of the employment debate are represented, from predictions of 90% unemployment in 20 years to those who see no basic connection between automation and unemployment. Several case studies of automation in specific industries are presented, along with glowing accounts of "Manpower Reduction Programs" and "labour substitution" schemes.

The social implications of progress in "artificial intelligence" is also well presented, with opinions ranging from Herbert Simon, Professor of Computer Science and Psychology, who believes that human beings can be understood as merely another kind of data processing machine, to Joe Weizenbaum, MIT Professor of Computer Science, who believes that there are some jobs which computers should not do, even if they can do them more efficiently than a human.

The book is designed as a series of readings forming the basis of management, trade union and school courses on society and technology. It brings together papers and articles published over the last five years, and provides a glossary of terms for those new to the field and a guide to further reading at the end of each chapter. As a collection of works the book is sometimes repetitious, but this is more than outweighed by the availability in one source book, of many different perspectives on the same issues. The material is well arranged and presented by editor Tom Forester and is for the most part understandable and clearly argued.

Perhaps the over-riding message of this book is that the future is in our hands, for better or worse. Decisions which are being made now, or are going by default, will determine the shape of our society and the place of the individual within it. If, as one author suggests, urgent government action is required to avoid the gradual emergence of a repressive, totalitarian society, and no action is being taken, or even looks like being

taken, then what is the worth of an individual in a "post-industrial" society? The same author states that planning and decisive action is required to prevent the centralisation of information and hence power in the hands of an elite minority, and to ensure that the benefits of the new technology will be equitably shared among all members of society.

"The Microelectronics Revolution" is a catalyst of the debate on the future, raising the essential issues in a clear and thought-provoking way. It is essential reading for anyone concerned at the directions our society is taking and interested in the future. It deserves a wide audience.

Our review copy came direct from the publishers, but copies should be available at technical book stores. Copies should also be available in every school, office and factory in the country. (P.V.)

## PLL Synthesizer Cookbook

**PLL SYNTHESIZER COOKBOOK**, by Harold Kinley. Published by TAB Books 1980. Soft covers, 279 pages, 131x209mm, illustrated with circuit diagrams and frequency tables. Price \$9.95.

PLL or Phase Locked Loop circuits are being increasingly used in radio communications, such as CB radio and FM/AM tuners. The advantages they offer include digitally programmable frequency selection with the accuracy and stability of quartz crystal. Unfortunately there are very few basic texts on this subject so this book should prove itself useful.

We should point out though that this book is intended more for the CB radio technician than for the hobbyist — unlike other so called "cookbooks". This is not surprising since the author, Harold Kinley is in fact an experienced technician and has written one other book on CB radio equipment.

Chapter 1 provides a brief introduction to PLLs and includes programmable dividers phase detectors, charge pumps, filters, VCOs and mixers. The discussion is at a very elementary level with block diagrams and some typical circuits shown. The 10 remaining chapters are each devoted to a different synthesiser IC; in order, they are PD2816C, SC42502P, REC86345, PLL02A, MM55104N, PD858C, PD861C, MM55106, MN6040 and a number of Toshiba chips.

Data on these chips is fairly difficult to obtain so the book is useful in that each chapter provides a block diagram of the chip along with the pin outs. Various features of each chip are mentioned as well as discussion of its operation. The block diagram of a particular CB radio which uses the chip plus a circuit



diagram is included along with alignment procedures and trouble shooting hints.

Five appendices are provided and these cover most of the other chips used in CB radios, eg PLL03A, M58473P.

The large amount of usually hard to get data, plus trouble shooting hints and circuit diagrams make this book most interesting for those interested in CB radio technical details and in this respect we can certainly recommend it. Our review copy came from Technical Book & Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne, 3000. (Rde)).

## Amateur handbook

**AMATEUR OPERATOR'S HANDBOOK, Revised Edition published 1980 by Postal & Telecommunications Dept. Stiff paper covers, 248mmx171mm, 105 pages. Price from Australian Government bookstores \$3.60.**

The foreword in the new edition of the Amateur Operator's handbook reads:—

"This Handbook outlines the conditions governing the establishment and operation of radio stations in the Amateur Service, and is intended as a manual for the guidance of amateur station licensees and persons preparing for the Amateur Operators' Certificate of Proficiency."

"The Handbook also specifies the qualifications required and outlines the procedures for obtaining amateur operator certificates of proficiency and licenses.

"The rules pertaining to the Amateur Service are derived from the Radio Regulations published by the International Telecommunication Union (ITU) and the Australian Wireless Telegraph Regulations. Relevant extracts from these regulations are contained in Appendices 2 and 3.

"It is desirable that a copy should be held by all amateur station licensees in Australia, for general reference."

That aptly describes the contents which will be of interest and help to aspiring amateurs as well as those already enjoying the hobby.

Revised in December 1978 and printed in 1980 this edition, issued by the Radio Frequency Management Division, Postal and Telecommunications Department, is available from Australian Government bookshops for \$3.60 a copy. (P.H.)

## Computer guide

**THE SECRET GUIDE TO COMPUTERS, by Russell Walter. Published 1980 by Scelbi Computer Consulting Inc, Elmwood, USA. Stiff paper covers, 6mm thick, 275mmx210mm. Price in Australia \$2.75.**

My first reaction, on reading the foreword, was to wonder what kind of a  
(Continued page 112)

# NEW BOOKS

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Latest editions of some of the most popular books on the subject:

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RSGB Handbook Volume 1	\$21.85
RSGB Handbook Volume 2	\$18.90
Reference Data for Radio Engineers (New Edition) ITT	\$39.95
Radio Handbook (William Orr) 21st Edition	\$27.75
Australian Amateur Operator's Handbook — Postal & Telecommunications Department	\$ 3.60
Radio Amateur Callbook 1981 editions — Just out! US Listings	\$25.40
DX Listings — all other countries	\$24.00
World Radio TV Handbook 1981 — Just out — Complete directory of the world's radio and TV stations — short medium and long wave. The listener's bible	\$17.95

## Adam Osborne Books

The 8086 Book — Rector	\$18.00
80800 Assembly Language Programming — Leventhal	\$15.00
Introduction to Microcomputers, Osborne	
Vol 0 — Beginners Book	\$ 9.55
Vol 1 — Basic Concepts 2nd ed	\$15.00
Vol 2 Some Real Microprocessors — New Edition, Loose-leaf w/out Binder	\$19.00
With Binder	\$30.00
Vol 3 Some Real Support Devices — New Edition, Loose-leaf w/out Binder	\$19.00
With Binder	\$28.00
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6800 Programming for Logic Design	\$12.55
280 Programming for Logic Design	\$13.50
280 Assembly Language Programming	\$13.80
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8080A/8085 Assembly Language Programming	\$15.00
6502 Assembly Language Programming — Leventhal	\$15.00
8089 1/0 Process handbook — includes 8289 Bus Arbiter	\$ 7.15
Pet and the IEEE 488 Bus (GP1B) — Fisher & Jensen	\$18.00
Pet/IBM personal computer guide — Donahue & Enger	\$18.00
CRT Controller Handbook — Gerry Kane	\$ 7.15

## New Books from TAB

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nut had written this book. Having sought to motivate his readers to get involved in home computing, the author invites them to phone him with their questions any time during the day or night; he even offers to ring them back!

But, nut or enterprising author, his first chapter is "Chat with your computer", in which he encourages the reader, with or without a computer to hand, to absorb the elements of communicating via the keyboard in BASIC language. Rather than major on any one machine, however, he makes appropriate allowance for variations in the keyboard layout and logic conventions of typical small computers.

Chapter 2 "Make your computer think" seeks to increase the readers' confidence by going through a series of reactive conversational exercises.

Chapter 3 "Master your computer" gets into loop routines and various other keyboard exercises, based mainly on giggle rather than awe.

And, finally, chapter 4 "Tackle the tough stuff" gives a hint as to where all this light-hearted operator/computer banter may be headed. But, by that time, the reader/novice should have got over his/her initial bewilderment and be able more confidently to tackle a more ambitious textbook.

So, if you're curious and/or bewildered by computers, you should find Russell Walters' good-humoured book good value for the money. From Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne, 3000. (WNW)

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## Teletext systems

**TELETEXT AND VIEWDATA** by Steve A. Money. Published 1979 by Newnes Technical Books, London, reprinted 1980. Stiff paper covers, 151 pages 216mmx139mm, illustrated by diagrams and photographs. Price in Australia \$16.50.

Videotext, a collective term for video information systems is something of a hot subject in Australia at the moment. There is argument as to which systems are, technically, the most practical for Australia, and there is argument as to whether any of them will be really viable, given our limited population.

But, while the argument rages, if you want to know something about the technology behind videotext, this book by Steven Money should provide a lot of the answers. For your guidance the chapter headings are:

Introduction — The teletext signal — Data acquisition — Selecting the page — The page memory — The text display — Graphics and colour — Other Teletext features — Teletext production — Viewdata — Typical decoder systems — A look into future — Appendix, glossary, index.

Perhaps the writer, in 1979, did not foresee the magnitude of the system challenge that would be mounted by the French and Canadians but he does make the point that the basic technology described in the book holds true in principle.

Our review copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (WNW)

## Op-amp design made easy

**HOW TO BUILD AND USE ELECTRONIC DEVICES WITHOUT FRUSTRATION, PANIC, MOUNTAINS OF MONEY, OR AN ENGINEERING DEGREE.** By Stuart A. Hoenig, PhD. Second edition, 1980. Published by Little, Brown & Co, Boston. Stiff paper covers, 393 pages, 230mmx155mm. Price in Australia \$21.50.

The title, reinforced by the preface, might lead one to believe that this is a practical course for beginners — learn by doing. In a way it is but the Author is a lecturer at the University of Arizona, Tucson, and the beginners he has in mind are student newcomers to electronics. But, as students, they are not newcomers to technical terminology or to mathematics, through to calculus. And they have access to laboratory facilities.

So, if you want to learn about Op-amps in a practical and interesting way, and you have enough technical background

to jump in at the deep end, Stuart A. Hoenig will help you to swim, in the technical sense.

Freely interspersed with mathematical expressions, formulas and graphs, he looks at the broad structure of electronic technology, and explains the role of the modern Op-amp in basic circuitry, such as filters. He then proceeds to look at typical circuit applications, with particular emphasis on biomedical and computer sub-systems. It's all circuits and lash-ups rather than finished projects.

Hoenig rounds off the book with a discussion of possible Op-amp problems, "Discrete Devices (If you must use them)", Conclusions, Appendices, "Where to Buy", Bibliography and "An Informal Glossary of Technical Terms".

There's a lot of reading between the two covers but anyone prepared to work through this book, would be rewarded with a few giggles and a lot of valuable background. Our review copy came from Australia and New Zealand Book Co Pty Ltd, 10 Aquatic Drive, Frenchs Forest, NSW 2086. (WNW)

## Telephone accessories

**MORE TELEPHONE ACCESSORIES YOU CAN BUILD.** By Jules H. Gilder. Stiff paper covers, 129 pages, 207mmx132mm, illustrated by diagrams. Published by Hayden Book Co Inc, Rochelle Park, NJ, USA. Price in Australia \$8.50.

This is a follow-up to an earlier book "Telephone Accessories You Can Build". The main difference is that the projects here are, on average, more advanced and, in many cases, require direct connection to the phone line. If this is frowned on in the USA, it is doubly so in Australia, where the phone system is provided by a single Government Authority, Telecom.

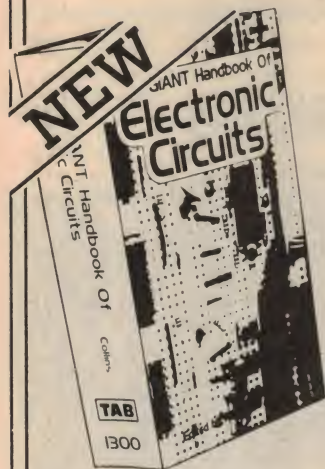
Be that as it may, there are 27 suggested projects including such things as music or synthesiser on hold, visual ring indicator, call length limiter and timer, crank call eliminator, etc.

A number of projects show the construction of simple and more complicated house telephone systems, which would be quite legal, if you can pick up the necessary bits, ex-disposals. Then, back to more general things and to various types of auto and memory diallers and a couple of projects to do with anti-bugging.

Circuits are given, a few PC patterns and a few simple diagrams but no detailed constructional information. Most would be within the capabilities of an experienced hobbyist but, before getting involved, it would be wise to consider the legality of many of the projects and the possibility of putting your phone service at risk. Our review copy came from Butterworths, 565 Pacific Highway, Chatswood, NSW 2067. (WNW)



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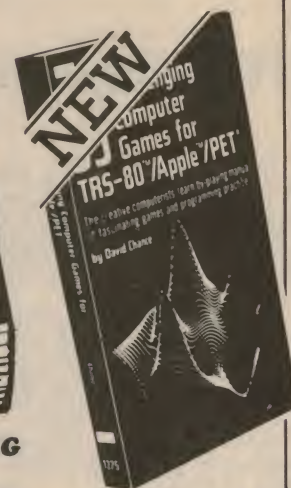
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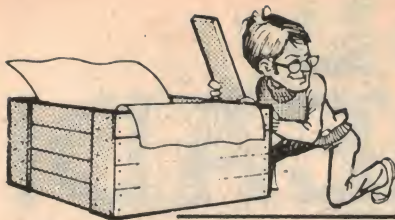
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# New Products

## High-power speaker system for PA & discos

In response to strong demand, Jaycar has produced a high-power Bass/PA speaker system suitable for pop groups, discos and other applications requiring high power sound systems.

The bass-reflex enclosure, measuring 590 x 390 x 730mm (W x D x H), features a massive 45cm diameter bass driver conservatively rated at 200W RMS. This unit is made in England by the well-known Celestion organisation. Two Motorola piezo horns cater for the top end of the system.

To keep the cost down, the system is available only in kit form. The kit (shown assembled in the photograph) includes all speakers, pre-cut cabinetry, Cannon connector, corner pieces, grille, heavy-

duty feet and screws etc. The carrying handles and carpet covering are available, if necessary, at extra cost.

Cost of the basic unit is \$495.00, including sales tax. This price is said to represent a considerable saving on other commercial built-up units.

Also available from Jaycar is a new string synthesiser kit that can simulate the string section of an orchestra, single instruments, brass, woodwind (eg clarinet), organ, piano accordion, plus several combinations of these. The unit is supplied complete with a 35-page instruction manual and a professional 49-note keyboard. Price is \$445.00 + \$10 p&p.

For further information contact Jaycar Pty Ltd, 380 Sussex St, Sydney 2000.



## Christie Rand is agent for Sabtronics

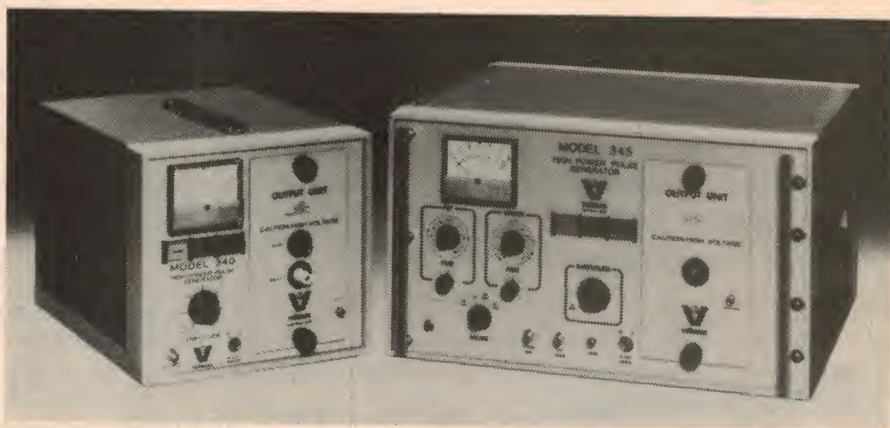
Sabtronics International recently appointed Christie Rand Pty Ltd of Sydney as their sole Australian distributor. Currently Christie Rand are offering two Sabtronics products for sale in assembled or kit form, with more to follow.

Currently available is the 2010 Digital Multimeter, which provides DC and AC voltage measurements from 100 $\mu$ V to 1000V in five ranges, DC and AC current measurements, resistance ranges and a diode test facility. Accuracy is 0.1% on DC and 0.5% on AC, and the meter is fully protected against overload. Price is \$138 for the kit, or \$161 assembled.

Also available is the 8610 600MHz frequency counter, with a guaranteed response from 10Hz to 600MHz and a sensitivity of 10mV to 100MHz, 50mV from 100 to 450MHz, and 70mV to 600MHz. Accuracy is said to be 1ppm  $\pm$  1 digit. Price is \$202.40 in kit form, or \$225.40 assembled.

Christie Rand will also soon have available a 1GHz frequency counter and the 5020 Function Generator, which offers outputs from 1Hz to 200kHz in five ranges, with sine, square and triangle waveforms.

Further information on these products may be obtained from Christie Rand Pty Ltd, PO Box 48, Epping, NSW 2121. Telephone (02) 477 5414.



## Tecnico has pulse generators

Tecnico Electronics has been appointed the exclusive Australian distributor for Velonex, USA, a company well known as producers of quality high power pulse generators.

Velonex has just introduced a completely self-contained high power pulse generator that operates from 0 to 100,000 pulses per second. The Model 345 will produce a power output of 5kW with pulse widths ranging from 80ns to 10ms. With the addition of a standard plug-in module, power spikes to 11.4kW may be generated. Typical applications include the investigation of transient response and the testing of high power

equipment.

Also from Velonex is a range of miniature LCD digital panel meters. The series 37 DPM features a 1.2cm high, 3 $\frac{1}{2}$ -digit readout, and extends only 1cm behind a front panel, making it one of the smallest panel meters available. Power required is a mere 40mW from a 5V supply, and a 9V battery version is also available.

The range of the digital panel meters extends from 200mV to 200V full scale deflection, and combined accuracy, linearity and offset specifications are given as  $\pm$ 0.5% of reading  $\pm$ 1 digit.

More information on Velonex products can be obtained from Tecnico Electronics, PO Box 50 Lane Cove, NSW, 2066.



## Switching type DC power modules

Warburton Franki now has available the Stevens-Arnold WP series of DC-DC power modules. The modules feature a wide input voltage range, and will deliver 25W from standard inputs of 24, 28, 36, 48 or 60V. Input-output isolation is in excess of 1GΩ at 500V DC.

Remote sensing and overvoltage protection are standard, and the supply's output may be switched on and off with a logic signal which is compatible with open collector TTL or CMOS circuitry.

The modules are switching type supplies, with a switching frequency of 100kHz and come in a 64 x 114 x 20mm package. The package includes a continuous six-sided shield, and the transformers are also shielded.

The 25W WP series offers five different outputs: 3V at 6A, 5V at 5A, 6V at 4.5A, 12V at 2.5A and 15V at 2A. Full load regulation is said to be better than 0.5%.

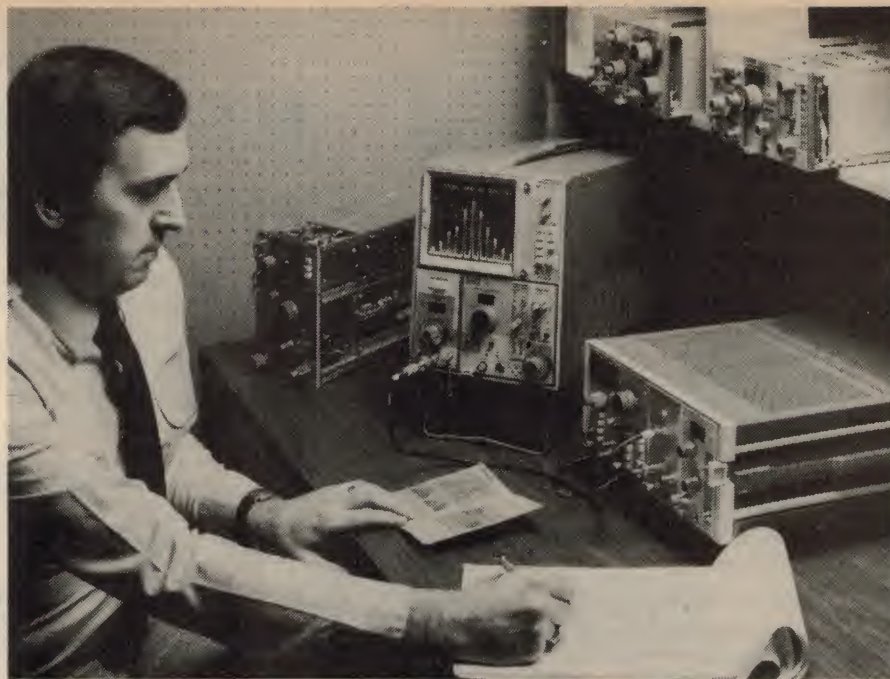
For further details contact your local Warburton Franki office.

## New range of heatsink extrusions

Autotron Australia has available a range of heatsink extrusions which are said to offer several advantages over conventional types. The XA series of heatsink extrusions are designed to function as an integrated heatsink and chassis, providing a high degree of heat dissipation while requiring no additional chassis or support metalwork.

A single item can be used as both heatsink and chassis, and the design includes mounting feet.

For more information contact Autotron Australia, PO Box 202, Glen Waverley, Vic 3150.



## Computer-aided oscilloscope calibration

Tektronix Australia Pty Ltd now has available the CG551AP ScopeCal Procedure Development Aid (SCPDA) – a software product designed to allow a technician skilled in oscilloscope calibration technique, but not necessarily experienced in computer programming, to develop his own customised computer-aided calibration procedures.

The result, according to Alan Stehr, Regional Sales Manager, "is a step-by-step procedure that will guide an operator through even the most involved calibrations, eliminating the possibility that a critical step may be overlooked".

In addition to minimising the chance of operator error and reducing the time

spent in calibration procedures, ScopeCal techniques provide easily-analysed management data. Once data is stored as part of a computerised system, calibration schedules can be developed to allow the most efficient use of all instruments. The need for subjective judgements which may vary from one operator to another is eliminated.

The Tektronix ScopeCal Procedure Development Aid software is designed to be used with the CG551AP, a microprocessor-based oscilloscope calibration generator that is fully programmable and an integral part of a system using the GPIB (General Purpose Interface Bus, or IEEE 488 standard). Although the Calibration Generator can be used manually, it would typically be used as part of a system including a controller such as the Tektronix 4052

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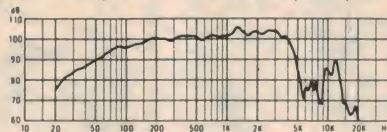
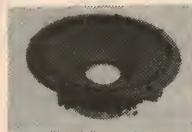


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	& 15VCT	1A	WA NT \$5.50
JT 274	0-9 5V	10A	<b>JT320 36-0-36V 2A</b>
	& 2x0-12V	1A	

100µF 500V DC W Electros **\$3.90** ea. 4 for **\$13.50** P-P \$1.25

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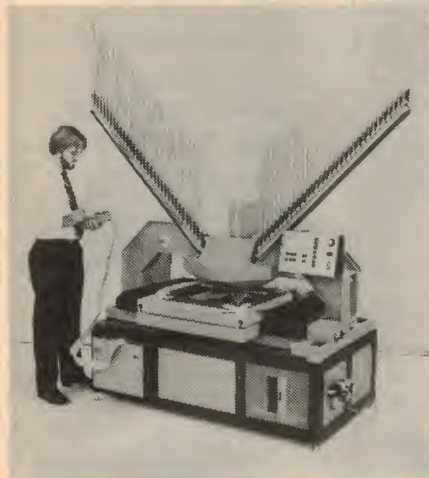


## New Products

Graphics Computing Controller for program development and execution, and a printer for automatic documentation. The SCPDA software is written in 4050 Basic.

Further information may be obtained from Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde, NSW 2113.

### Automatic IC insertion machine



Royston Electronics recently held a successful seminar on cost reduction and improved reliability in electronic circuit manufacture. As part of the seminar, Mr Dennis Janda, Applications Technical Engineer for the Amistar Corporation of the USA, spoke on automatic IC insertion using Amistar equipment.

Following on from the seminar, Royston Electronics now has available the Amistar C1-1800, an improved automatic DIP insertion machine

featuring a microprocessor-based control system. The system may be easily interfaced with CAD/CAM computer systems or teletype, and a hand-held program control box allows the operator to control the machine while moving around the factory floor.

Further details are available from Royston Electronics, 27 Normanby Rd, Notting Hill, Vic 3168.

### Power booster for Icom transceiver



Icom Corporation recently announced the release of a power booster for the popular IC2A hand-held transceiver. The IC-ML1 is a low power booster designed to allow the IC2A to be used in mobile operations. Because of its small size and lightweight the amplifier can be easily mounted in a vehicle or boat, considerably expanding the usefulness of the IC2A transceiver.

Vicom International Pty Ltd advise that they have a limited number of the power boosters in stock. The company can be contacted at 68 Eastern Rd, South Melbourne, 3205, or 339 Pacific Highway, Crows Nest, NSW 2065.

### Wirewound power resistors

Everest Electronics of Adelaide, the sole Australian agents for Ashburton Resistance Co Ltd, now market the Arcol range of metal-clad wirewound power resistors, with most types available ex stock. Although these components are widely used in professional and industrial equipment they have not been readily available in Australia until now.

The resistors are available in ranges 1Ω to 100kΩ, with a standard 5% tolerance, and in sizes from 10W to 300W. They are housed in ribbed aluminium packages designed to be mounted either vertically or horizontally directly on a chassis for heatsinking. Maximum surface temperature is given as 200°C.

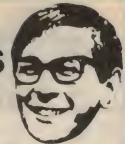
Also from Everest Electronics are the Arcol series of water-cooled power



resistors, a component often used by manufacturers of high frequency and induction process heating equipment.

For more information contact Everest Electronics, 61 Compass Drive, Seaford, SA 5169.

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Mother Board —

Printer Drive, 8 Relay Drive.

1. Mother Board — 8 Slot
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- EP3 Extended Monitor
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- 9. Dual VIA"

Drilled Boards extra.

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## RESISTORS

150 ohm, 5W	20c
10 ohm, 5W	20c
47 ohm, 5W	20c
12 ohm, 3W	20c
2.5 ohm, 3W	20c
33 ohm, 3W	20c
8 ohm, 10W	25c
4000 ohm, 10W	25c
1000 ohm, 5W	20c
330 ohm, 10W	25c
220 ohm, 5W	20c
5 ohm, 5W	20c
220 ohm, 10W	25c
950 ohm, 3W	20c
115 ohm, 5W	20c
10 ohm, 5W	20c
1k ohm, 5W	20c
5000 ohm, 5W	20c
6.8k ohm, 3W	20c
3300 ohm, 10W	25c
6800 ohm, 10W	25c
1500 ohm DUAL, 21W	50c
50 ohm, 5W	20c
330 ohm, 5W	20c
1k ohm, 5W	20c
820 ohm, 5W	20c
12 ohm, 10W	25c
470 ohm, 7W	20c
4700 ohm, 4.5W	20c
5000 ohm, 10W	25c
8.2 ohm	5W
3.3k	5W
27 ohm	5W
10k	7W
2.5 ohm	3W

## CAPACITORS

0.56 250V	40c ea
2000 MFD, VDCW25	75c ea
0.0039uF, 1500V	20c ea
6N8, 1500V	20c ea
0.0068uF, 1500V	20c ea
1200PF, 400V	10 for \$1
0.068uF, 400V	5 for \$1
2200PF, 630V	10 for \$1
0.47uF, 250V	10 for \$1
0.10uF, 400V	5 for \$1
0.082uF, 160V	10 for \$1
26k, 250V	10 for \$1
0.041uF, 400V	10 for \$1
0.033uF, 250V	5 for \$1
0.027uF, 100V	20 for \$1
220uF, 10V	10 for \$1
1uF, 350V	10 for \$1
470uF, 40V	5 for \$1
1000uF, 16V	25c
2.2uF, 200V	10 for \$1
0.047uF, 1500V	50c
47uF, 25V	4 for \$1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF, 63V	10c
0.47uF, 400V	50c
680K, 250V	50c
012, 250V	25c
15NF, 250V	10c
120K, 250V	20
10uF, 315V	25c
0.056, 250V	10c
500 MFP 10 VOLT	5 FOR \$1

<b>Slide Pots</b>	
250K-50K	3 for \$1
Dual 500K	3 for \$1
1 Meg	3 for \$1
2 Meg	3 for \$1
Including Fancy Gold Knobs	
25K dual	2 for \$1

<b>SPECIAL</b>	
100 mixed resistors, all useful	\$2.
100 mixed capacitors, fresh stock	\$2.

<b>AUDIO LEADS</b>	
3.5m to 3.5m, 7ft	75c
3.5m to 6.5m, 7ft	75c
6.5, 7ft	50c

<b>MICRO SWITCH</b>	
5A, 250V AC	75c ea.

<b>TUNING CAPS</b>	
2 and 3 gang	\$1 ea.
Min 2 gang	50c

<b>FUSES</b>	
0.5A, 2A, 3.25	10 for \$1
In line fuse holders	30c
RCA jack plugs and sockets	40c pair
1A, 10 for	\$1

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BC 548	10 for \$1
AD 149	\$3 pr
OC9554	50c
BD202N	50c
BD135	50c
2NC055	\$1

## ELECTROS

470uF, 25V	.5 for \$1
400uF, 10V	.5 for \$1
47uF, 63V	.5 for \$1
350uF, 16V	.2 for \$1
27uF, 160V	.5 for \$1
25uF, 63V	10 for \$1
22uF, 160V	10 for \$1
47uF, 16V	.5 for \$1
47uF, 200V	.5 for \$1
220uF, 10V	10 for \$1
68uF, 16V	10 for \$1
100MFD, 350V chassis mount	\$1

- Telescopic aerials, \$1.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, \$5
- Line output transformers, 1200 to 3/ohm, 5 watt, \$1
- Power supply units, filtered, 240 to 20 volt, \$12

**Power leads** 240 volt, suit most tape recorders, radios, etc. \$1 each.

**TV Stick Rectifiers** 20SC, \$1.00.

**Philips Colour TV Convergence Boards**, \$3 each.

**455KC IF Transformers** for valve radios, \$1 each. Also aerial and OSC coils, 75 cents each.

## POTS ROTARY

1/2 Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7,500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/Ohm	50c
1/2 or 1 Meg Switch	50c
1/2 1 meg dual Concentric tapped at 100K	\$1
2 meg ganged double pole switch	\$1
1.5 meg dual ganged	50c
2 meg ganged log	\$1
1 meg dual ganged	\$1
1/2 meg dual ganged LIN	75c
25K, 50K dual ganged Concentric double switch	\$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

**HOR Drive 3021 transformers** for colour TV \$2  
**TV Colour Convergence Units** 11270 44 x 6 \$3

**PILOT LIGHTS**  
Screw in 6.3V 10 for \$1.50  
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Pilot light holders \$1.50

- Car radio suppressors, 3 for \$1
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- Toggle switches, 25c
- 2 position push button switch, 50c
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- In-line fuse holders, 4 for \$1
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Pick up Cartridges BSR universal type Ceramic Stereo. \$5  
Audio Technica AT6 diamond stylus stereo \$12

## DIODES

OA 626	4 for \$1.00
OA 662	4 for \$1.00
EM 410C	4 for \$1.00
DS 150A	50c
DSY 130YO	50c
OA 636	50c
HR 15	50c
Diodes BYX 55, 300	30c
BY 188	30c

**DIODES BAV20 10 for \$1**

Valve sockets 7 pin	10c
Valve sockets 9 pin	10c
OCTAL	10c

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**GRAMOPHONE** motor and pickup 3 speed stereo balanced arm.

240 volt \$9.75

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## COLOUR 26" TV BOARD

TO SUIT PHILIPS, PYE, KRIESLER

\$40

**FRONT END COMPLETE PUSH BUTTON TUNER SECTION**  
TO SUIT PHILIPS, PYE, KRIESLER ETC, \$25



**PICK UP ARMS**  
Mono \$3.50  
Inc Ceramic Cartridge & Stylus

<b>TRIMPOTS</b>	
200 ohm	10c
5K	10c
100K	10c
47K	10c
10K	10c
470 ohm	10c

Miniature speaker and drive output transformers \$1 pr

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Inc one 6 x 4 speaker, 5W RMS, \$4.75 ea.  
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(For singles or pairs.)

## SPEAKER SPECIALS

15 ohm 4" — 2 for \$2.  
6x9 15 ohm \$5 each  
5x7 15 ohm \$4 each  
8x4 15 ohm \$4 each  
6x4 15 ohm \$3 each

5" 3.58 or 15 ohm \$3.50 each

## SUPER SPECIALS

### FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY \$22  
P&P \$1.00

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2N3055	\$1.20
SE1002	4 for \$1
BF459	50
B544 DE6	50
C106 F1	50
TIP 110	50
608EK	4 for \$1
BCS548	10 for \$1
2SB186	50
2SA101	50
BD263	50
BSB405	50
2SB77	50
2SB303	50
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## VU & BALANCE METERS



STEREO VU \$3.00



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## TV TUNERS

\$2.50 + P + P





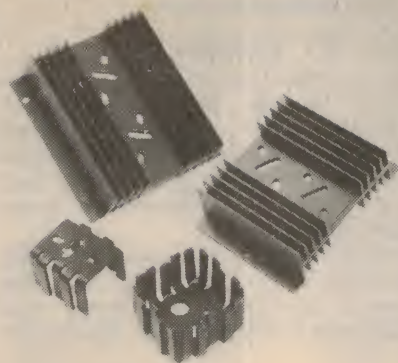
## New Products

### K & W heatsinks and instrument cases

Now available from K & W is a range of heatsinks designed for medium to high power semiconductors. They are a black anodised aluminium multi-finned design, and are extruded with provision for both horizontal and vertical mounting.

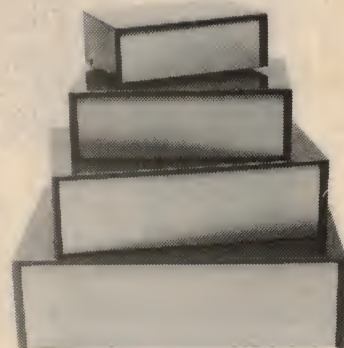
The heatsinks are available in pre-cut sizes from 40mm to 150mm, and may be ordered pre-punched with universal package mounting holes which suit TO-3, TO-66 and TO-220 packages.

Also from K & W are the "C" series of instrument cases, in sizes ranging from 100mm (C453) to 305mm (C1284) wide and 95mm to 195mm deep. The cases are constructed with dimple feet pressed into the aluminium base. The aluminium



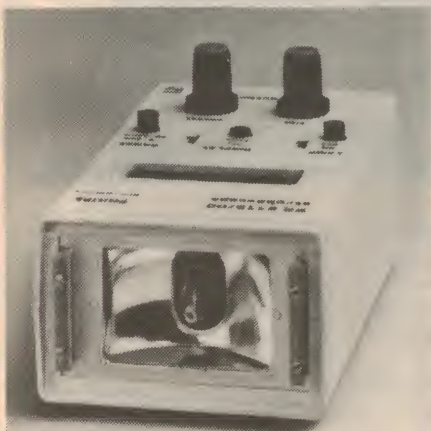
front panel has a satin finish for those "dressy" projects, and the top and side cover is steel, finished in hammer tone blue. The top cover is formed to recess the front panel.

Ballarat Electronic Supplies (5 Ripon St, North Ballarat, Victoria) is the wholesaler, but K & W products are sold in Melbourne by Ellistronics, J. H. Magrath and Co Pty Ltd, Radio Part Group, Tasman Electronics, Rod Irving Electronics, Truscott Electronics, Stewart Electronics and David Reid. Distributors in Sydney include Radio Despatch Service, Jaycar Pty Ltd, Electronic Agencies, David Reid and Pre-Pak



Electronics. In Perth, contact Atkins Carlyle.

### Compact stroboscope from Philips



This new pocket-sized universal stroboscope from Philips is mains-powered and features an output frequency of 3-330 flashes per second, a 5-digit LED display, and a quartz timebase for high stability. The display can be switched to give flash rate per minute or per second.

Built for laboratory and industrial use, the PR 9115 is protected by a strong plastic housing and features a built-in flash lamp which can be switched off independently of the stroboscope itself. The xenon flash lamp is protected against overload by an automatic switching device.

Flash intensity is approximately 450 Lux at 0.5m from the target object. The illuminated area at the same distance is 0.75m diameter. Dimensions of the PR 9115 are a compact 92 x 83 x 160mm and weight is 0.65kg.

Commerical enquiries to Philips Scientific and Industrial Equipment, 25 Paul St, North Ryde 2113.

### TV sync measurement on HP 100MHz scopes

Hewlett-Packard Australia Pty Ltd has introduced television sync measurement capabilities as an option on its 100MHz Models 1740A, 1741A and 1742A oscilloscopes. The new Option 005 adds the circuits and controls necessary for triggering on a composite video signal

*Continued on p120*

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2. Frequency Tolerance	$\pm 30\text{ppm}/28^\circ \pm 1^\circ\text{C}$
3. Drive Level	1 $\mu\text{W}$ max
4. Series Resistance	31.0k ohms max
5. Q Factor	40000 min
6. Parabolic Curvature Constant	Less than $-0.04\text{ppm}/^\circ\text{C}$ (Refer Fib. 1)
7. Turnover Temperature	$28.0^\circ\text{C} \pm 5^\circ\text{C}$
8. Capacitance Ratio	700 max
9. Storage temperature Range	$-30^\circ\text{C} \sim +80^\circ\text{C}$
10. Operating Temperature Range	$-10^\circ\text{C} \sim +60^\circ\text{C}$
11. Aging rate	Less than $\pm 5\text{ppm}/\text{year}$
12. Shock	Less than 5ppm for 50cm
13. Package size.	Hammer Shock Test



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\$135

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YES — This is the latest "Superior Quality" Super Slim "Solar-power" Alarm Chronograph — Displays 12 Functions WITH 1/10 sec. Lap-Time, Stop-Watch, 12/24 Hour Selectable System, AND Loud Daily Alarm. Waterproof to 100ft, Shockproof, 100% Stainless Steel, Mineral Glass, Instructions, 2 Year Guarantee.

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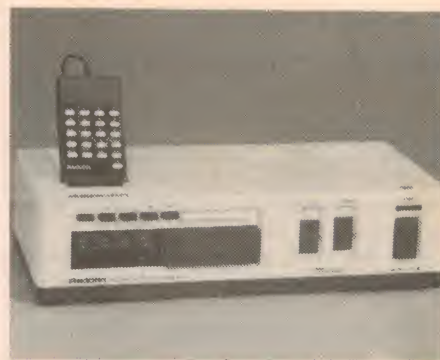
**TRADE ENQUIRIES WELCOME**

## New Products

### TAB information now on Teletext

Sydney television station ATN-7 has expanded the scope of its Teletext service to provide racing and trotting data from the TAB computer. The new service means that off-course punters now have access to the same information as on-course punters.

Essentially, "armchair punters" are able to receive a full racing service, including pre-race dividends, scratchings, race results and prices paid with information



Above right is the Radofin "Adam 180" teletext adapter, while at right is a typical TAB teletext display.

MELBOURNE - RACE 10 - MOONEY VALLEY			
APPROX. DIVIDENDS FOR \$2.50 INVESTMENT		BETTING CLOSES AT 2.35PM	
HORSE	WIN	PLACE	HORSE
1	2.20	1.90	11
2	0.90	0.60	12
3	4.10	1.00	13
4	1.80	0.70	14
5	4.90	1.30	15
6	3.40	1.40	16
7	10.00	2.30	17
8	SCRATCHED		18
9	1.50	0.60	19
10	7.50	2.00	20

updated every 10 minutes. Information is provided for all races for up to four race meetings at a time.

To receive Teletext transmissions, viewers either need a special television set with an in-built decoder or an external adapter unit. One unit currently available is Radofin's "Adam 180"

Teletext adapter, which retails for around \$475. This unit connects easily to any standard television receiver and is operated by means of a cord-connected remote control.

For further information, contact Radofin Electronics (Aust, 5 Curlewis St, Bondi 2026. Phone (02) 309 1957.

### TV sync measurement...

cld from p119

while maintaining measurement capabilities, and is intended for use in the design and fault-finding of products including VCRs and video disc players, as well as raster display devices.

The Option involves modifying the inputs of the oscilloscope to match video signals. Channel A incorporates a built-in 75Ω input for impedance matching of most video sources. Channel B has a TV clamp that stabilises the display of video signals, enabling the scope to lock onto complete frames of video. A TV line scan capability allows individual lines to be singled out for inspection and measurement, and segments of individual lines may also be examined in the triggered mode, using the Single Line Scan control.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St, Blackburn, Vic 3130.



Television sync measurement capabilities are now available as an option on H-P 100MHz oscilloscopes.



# The moving coil replacement from Stanton Magnetics... the revolutionary 980LZS!



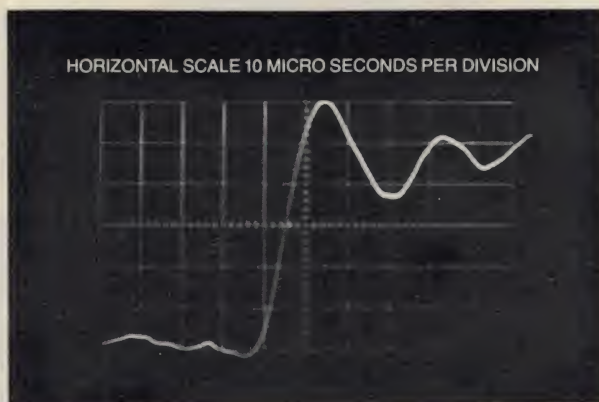
Now from the company to whom the professionals look for setting standards in audio equipment comes a spectacular new cartridge concept. A low impedance pickup that offers all the advantages of a moving magnet cartridge without the disadvantages of the moving coil pickup. At the same time it offers exceedingly fast rise time—less than 10 micro seconds—resulting in dramatic new crispness in sound reproduction—a new “openness” surpassing that of even the best of moving coil designs. The 980LZS incorporates very low dynamic tip mass (0.2 mg.) with extremely high compliance for superb tracking. It tracks the most demanding of the new so called “test” digitally mastered and direct cut recordings with ease and smoothness at 1 gram  $\pm \frac{1}{2}$ .

The 980LZS features the famous Stereohedron™ stylus and a lightweight samarium cobalt super magnet. The output can be connected either into the moving coil input of a modern receiver's preamps or can be used with a preamp, whose output is fed into the conventional phono input.

For “moving coil” audiophiles the 980LZS offers a new standard of consistency and reliability while maintaining all the sound characteristics even the most critical moving coil advocates demand. For moving magnet advocates the 980LZS provides one

more level of sound experience while maintaining all the great sound characteristics of cleanliness and frequency response long associated with fine moving magnet assemblies.

From Stanton... The Choice of The Professionals.



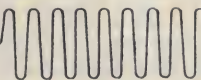
*Actual unretouched oscilloscope photograph showing rise time of 980LZS using CBS STR112 record.*



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NSW Office: 7 Jordan Rd., Wahroonga, 2076. Telephone: 487 2543.





**'YOU'LL BE WET, YOU'LL BE  
AND FRIGHTENED, BUT  
KNOW THAT YOU'VE GOT**



# NAVY

THE PRIDE OF THE FLEET IS YOU.

‘In the days when our Navy was young,  
and the ship was the pride of the fleet.

You’d gaze out at her in wonder,  
made an old sailor’s heart skip a beat.

Well the ships have gone through  
some changes,

And the roles have changed a bit too.

You’ll be wet,

You’ll be homesick and frightened,

But the pride of the fleet will be you.’

Our ships are equipped with  
some of the finest and most  
advanced technology in the world.  
So it stands to reason that we’re  
proud of them.

It also stands to reason that we  
need the men to make them work.

Men who, in the Navy, have  
discovered what they do best and  
have been trained to achieve it.

Men with pride in themselves  
and what they can do. Whatever  
the conditions.


Because pride is what it’s all  
about really.

In the Navy we’re proud of the  
Fleet. But we’re prouder still of  
the men who work it.

Talk to a Navy Careers Counsellor. He’ll tell you about today’s Navy and the kind of men that it needs. It could be a proud moment for you both. So, pick up a phone now. Or write to G.P.O. Box XYZ in your state capital.

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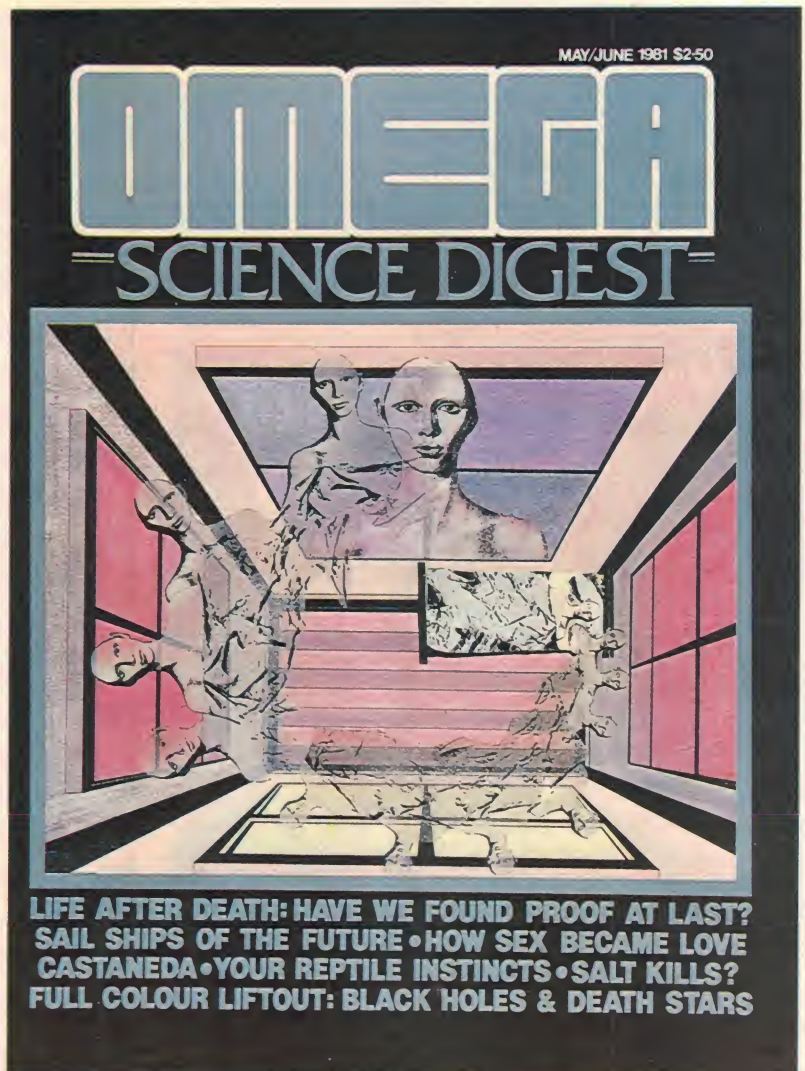
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REVIEWS OF RECENT

# Records & Tapes

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## MORE SYNTHESISED BACH: "Sometimes very enjoyable"

**JOHANN SEBASTIAN BACH — Switched-on Brandenburgs. Complete Concertos 1-6. Virtuoso Synthesiser Performances by Wendy Carlos. CBS Stereo 79227. (Two boxed discs.)**

The Moog Synthesiser is a sophisticated combination of electronically produced sounds some of which come close to duplicating the timbre of conventional musical instruments, others producing timbres never heard before.

One of its outstanding features is an astonishing clarity of texture in even the most complex musical passages from solo instruments right up to combinations of full sized symphonic orchestral stature. The crispness of its articulation make it specially useful in reproducing — or perhaps transcribing is nearer the truth — baroque music.

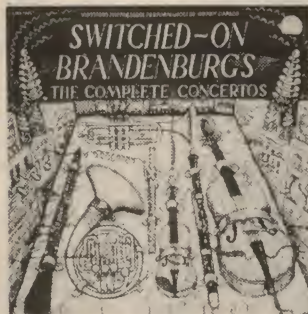
I first heard the Moog (pronounced Moag, by the way) on a 1968 CBS disc entitled "Switched-on Bach" which featured several pieces by J.S.B. It was interesting, in this early example, to hear, artificially produced, many of the features mentioned above.

Before that one's electronic music had been restricted to Hammond organs and similar devices in the electronic field.

The present set of Brandenburgs is a much more ambitious enterprise and, to those who always express horror at the very idea of transcriptions, I would emphasise that J.S.B., himself was an unrepentant transcriber of other composers' music. The complexities of producing the countless changes of timbre that exist in the Brandenburg scores took the operators "over a dozen years" according to the cover notes.

Not unexpectedly, on this 4-sided set, some effects are better than others when it is a matter of imitation. Among the better is an extraordinarily realistic reproduction of legato string passages. Others have their own merits if regarded simply as transcriptions in their own right — that is music emanating from one source transferred to a different one.

The musicological/performance problems that had to be overcome by Ms Carlos and Elkin are set out in con-



siderable detail in a long interview with them which also accompanies the set.

Listening to these transcriptions those used to hearing them in their conven-

tional form are in for a few shocks — for the most part not painful. Surprising, yes, and sometimes very enjoyable! I cannot do more here than express the generality that in most of the many movements the fast ones are nearly always more satisfactory to hear than the slow ones. But even in the latter you are in for an occasional enjoyable surprise — and some nasty jolts, too.

I don't recommend playing all six concertos at one sitting but do suggest that you acquire a set. It is something more than a novelty and except for a few bars here and there, Ms Carlos shows a nice appreciation of baroque style. (J.R.)

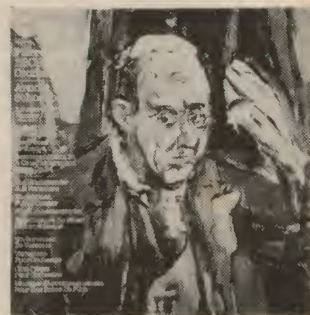
## SCHONBERG/BOULEZ "... a blinding headache"

**SCHONBERG — A Survivor from Warsaw, Op. 46; Variations for Orchestra, Op. 31; Five Pieces for Orchestra, Op. 16; Film Music, Op. 34. Conducted by Pierre Boulez. CBS Masterworks Stereo Disc SBR 235 935.**

This recital of works that might be loosely described as middle-period Schonberg share one feature in common — ugliness. The earliest of them (1912) is the Five Pieces for Orchestra. Schonberg was reluctant to give them names in order to prevent the listener from associating them with extra-musical images. However, his publisher insisted so Schonberg reluctantly added cryptic titles. All seem irrelevant except that of the third which he called Colours and which consists of a series of chords each merging into the next with subtly changing orchestration.

By the way, Schonberg's chief preoccupation at this period was painting and the reproduction of an anonymous painting on the record cover is reminiscent of the nightmare quality of the composer's work in this medium.

All five pieces are mercifully brief, the



longest lasting only four minutes forty seconds.

The other work on this side consists of three excerpts from music he wrote to accompany a silent film (1930). These are titled on the record sleeve — it doesn't say by whom — as Danger Threatens, Panic, and Catastrophe. When you hear them you might guess why the Hollywood producer didn't use them, especially back in 1930!

On Side 2 the Variations for Orchestra (1927/8) start quietly, almost romantically but, alas, only for a few bars before reverting to 12-tone little horrors — there are nine of them — with an occasional tuneless solo standing out.

A Survivor from Warsaw is music supporting a dramatic monologue delivered by a male narrator, Gunther Reich, which describes the horrible massacre by the Nazis of the Jews in the Warsaw ghetto. The narrator uses a kind of modified speech-song first used by Schonberg in



his Pierrot Lunaire. Reich's accent often makes it difficult to make out what he is talking about but it all sounds as if something dreadful is going on. To finish the piece an anonymous male choir breaks in with the ancient Jewish national hymn, Shema Yisroel, not with any great effect except gloom.

You may be into this kind of thing, as they say nowadays, in which case this disc should interest you. I, who listened to both sides of the disc at one sitting, finished with a blinding headache. (J.R.)

☆ ☆ ☆

**RIMSKY-KORSAKOV — Scheherazade.**  
Complete suite in four movements.  
London Philharmonic Orchestra conducted by Bernard Haitink. Philips Stereo Cassette 7300 226. Also available on disc.

Somehow I didn't expect Haitink, despite my respect for him as a conductor, to present the glitter that usually accompanies the playing of Rimsky-Korsakov's music at its best. "Like a child playing with coloured bricks," it was once described by someone whose name I've forgotten.

But there is an alternative aspect in Haitink's playing in this disc that offers more than enough compensation for this difference. He uses a more symphonic style. Now this is quite logical because, after all, Scheherazade was composed as a "symphonic suite" and not as ballet music. Fokine's ingenious ballet use of parts of the suite used the whole of the first movement as an overture, started the dancing with a complete second movement, ignored the third and finished with the finale. But Scheherazade was conceived as a concert hall piece and that is just how Haitink treats it.

His opening of the first movement is quite solemn, with exquisite judgement in the balance of solo violin and harp. And he goes on to treat the rest of the movement with a sort of ground swell — for after all it was originally intended to depict a ship at sea. His is a weighty, broad reading.

The bassoon starts the second movement unusually slowly — and expressively — more so than he could in the ballet. And the oboe soloist, who follows, also "tenderises" the score. But when Haitink starts on the march-like section real excitement enters. His colours are rich, his rhythms quite wonderful. This over, he embarks on a slightly heavy-handed presentation of the second theme, just a little too beautifully nuanced: at least for my taste. But he goes on to finish with a superb climax.

The third movement, omitted, as I mentioned above, from the ballet, represents a love scene and is perfectly suited to Haitink's lover-like handling. The wind playing is quite marvellous here. Indeed, all through, the orchestral playing is of the very highest order. The Finale is a dazzling exercise in virtuosity from beginning to end.

## dbx discs are available — but you need a decoder

**MASTERPIECE SERIES, Vol III. Zoltan Rozsnyai conducting the Philharmonia Hungarica. Stereo, digital master, dbx encoded. M&K Realtime PS-1004. (From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.)**

M&K Realtime, once heavy promoters of direct cut recordings, have gone to the other extreme with a series of albums which use a Sony digital system for the master tape recording and dbx encoding for the disc itself. If ever a system should minimise noise and maximise dynamic range from an analog disc, it should be this.

There is one catch, however, in that to replay the disc properly, you need a dbx decoder in your amplifier chain, which will automatically and linearly double the dynamic range, as the disc is played, lowering the troughs and raising the peaks. Lowering the troughs automatically attenuates any residual disc noise, while raising the peaks should give you shattering climaxes, without ever having stressed the cutter, the disc or the playback cartridge.

As it happened, I didn't have a dbx decoder available when it came time to review this disc, so I have elected merely

to mention it by way of interest to those who have. Out of curiosity, I did play one side, despite the sometime warning that dbx encoded records are "unplayable" without the appropriate decoder. They are playable, of course, but you have to accept the idea that the orchestra is performing like a palm court group, steadfastly avoiding dynamics!

In this Volume III the tracks are: Carmen Prelude (Bizet); Rakoszi March (Berlioz); Hungarian Dance No. 5 (Brahms); Panambi Suite (Ginastera); Procession of the Nobles from Mlada (Rimsky-Korsakov).

Altogether six masterpiece albums are listed on the jacket, all containing popular classical excerpts and all available, if desired, in normal digital/analog form, or dbx encoded, as well. If you have a decoder available, you may like to know about them. M. R. Acoustics are the people to talk to, at the address as above (W.N.W.).

It is all quite wonderful but, if I must pick one feature for special praise, I would name the fast staccato brass passages which crackle with superb unanimity. The climax is a real stunner and the cassette sound would put many a disc to shame.

To conclude, a special word of praise for Rodney Friend's perfect playing of the important solo violin part that runs through the whole work. (J.R.)

## Enjoyable overtures

**WAGNER — Overtures to Rienzi, Tannhauser, Flying Dutchman and The Master-singers of Nuremberg. Philharmonia Orchestra conducted by Lorin Maazel. CBS Masterworks Stereo Disc SBR 235987. Also available on cassette.**

Only one of these overtures presents Wagner in his maturity — The Master-singers. Of the other three, one is an early work, the two others middle period. In the very first bars the recording of the Master-singers is a little light-on in the bass so that the slide down — unexpected in the days when the music was written — from C to B, does not make its full impact.

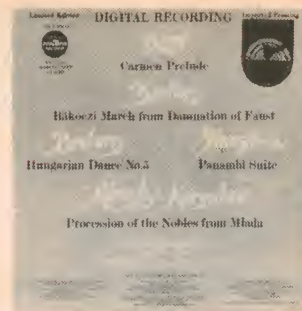
On the other hand when, towards the end of the overture, Wagner most ingeniously combines three themes playing at once — the bass here, especially

the tuba, is a bit too emphatic. Yet, in the double theme sequence that precedes this one, the balance is perfect. The wooing charm of the strings in the Prize Song passages and the delicate accuracy of the Apprentices' theme are indeed matters for the highest praise.

Maazel takes the last climactic Master-singers' theme rather slower than is usual. It can however be argued that this broadening in a concert performance of the overture only, and one which does not lead straight into the opera, tends to approach the ending in a way to make a better conclusion.

At any rate if you do not agree with the latter theory you will find ample compensation on the same side of the disc in the lovely soft playing of the wind in the Pilgrims' Chorus opening to the Tannhauser overture which follows. Here is playing of the utmost refinement which continues elegantly when the lower strings take up the theme. Importantly, to my mind, the pulsating figure that hovers over the same theme at its final appearance is most carefully weighed before its power is increased.

But whenever I hear the Tannhauser Overture, I always regret that it does not lead into the wonderful Paris version of the Venusberg music. However, Maazel makes the original version sound splendidly voluptuous. He also uses the Mottl version of the climax with the horns blowing their three descending notes for





## RECORDS & TAPES

all they are worth with their bells turned straight up.

On the second side I was surprised to still find some real excitement in the opening bars of the Flying Dutchman. Maazel shapes the contrasting Senta theme most beautifully and manages to still make the old piece sound very atmospheric. The Philharmonia is in top form and the sound splendid.

To end, there is the Rieni for those who want it. (J.R.)

☆ ☆ ☆

### VIVALDI FIVE ORGAN CONCERTOS.

Marie-Clair Alain (organ), Piero Toso (violin), Allessandro Bonelli (oboe), with chamber group I Solisti Veneti, conducted by Claudio Scimone. World Record Club stereo R 05300.

Most people familiar with Vivaldi's music will be aware that he wrote a few concertos for organ and violin. But I was surprised to learn that more have been discovered and some of these are presented on this record.

While some of this music is unmistakably Vivaldi, there is much that is delightfully different, giving the lie to the oft-heard glib opinion, "All of Vivaldi's music is the same." In fact, I spent a great deal of time listening to this record when I should have been otherwise occupied. It was thoroughly enjoyable.

While extensive notes are provided on the works themselves, there is no supporting material on the performers or the organ used. Recording quality is good and I have no hesitation recommending the disc.

The five concertos are as follows: Concerto in C Major, RV554, for oboe, violin and strings; Concerto in F Major, RV542, for violin, organ and strings; Concerto in D Minor, RV541, Concerto in C Minor, RV766 and Concerto in F Major, RV767, all for violin, organ and strings. (LDS).

## Vintage Graham, Burl Ives

**BILLY GRAHAM CRUSADE MEMORIES — Word, 20 Series, TWE-6004. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).**

Most Billy Graham Crusade recordings have a strong regional appeal but otherwise sound much of a muchness. This one is different, because it looks back over 30-odd years of world campaigning by the team.

The 20 tracks (hence the "20 Series" label) include a choir item from the historic Harringay Arena rally in London (1954) and another from Glasgow in the same year. There is a solo by Ethel Waters (New York, 1956) and another by Stuart Hamblen with his own Gospel hit "It Is No Secret".

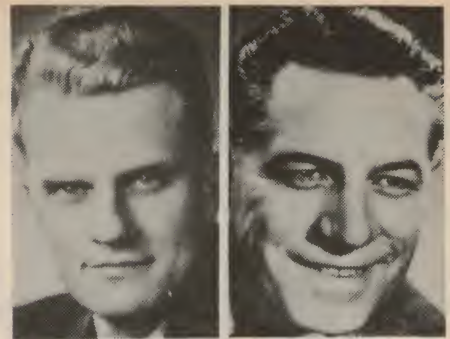
George Beverly Shea is well represented, of course, as is pianist Ted Smith and organist Don Hustad. Song

**LOVE AND JOY. Burl Ives. Word 20-Series TWE-6006. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)**

Here's another generous helping of Gospel nostalgia with 20 tracks from that unique minstrel, Burl Ives. Some of them are simple, traditional hymns like "The King's Business", "Jesus Loves The Little Children", "Will There Be Any Stars", "Love Lifted Me", "The Old Rugged Cross", etc.

**THE NEW DON BURROWS QUINTET. Cherry Pie CPF 1023. [PO Box 225, Pen-nant Hills, NSW 2121. Phone (02) 819 6151.]**

It is a pleasant change to be able to agree wholeheartedly with the sleeve



Billy Graham

Bev Shea

leader Cliff Barrows is mentioned in the text and shares a duet with Bev Shea.

Nostalgic pictures of the team — Graham Shea, Smith and Hustad — dramatise the fact of a working lifetime which has since been spent in Gospel campaigning. More than most such albums, this is a keepsake.

World Records apologise for the age and quality of some of the tracks but it is not such as to frustrate the historic role of the album. (W.N.W.)

Others are children's songs like "King Herod And The Cock", "The Friendly Beasts", "Our Helpers" and so on. Add a few traditional Burl Ives numbers like "Life's Railroad To Heaven" and "The Haven Of Rest" and you have this album. For many it will be too simplistic but it's that very folksy quality that ensured a lifetime of popularity for Burl Ives on TV, films, radio and records.

As usual, his diction is very clear, the recording quality is okay and, if you have a soft spot for B.I., you'll enjoy what this album has to offer. (W.N.W.)

notes on a record and, on this collection from the New Don Burrows Quintet, the comments about the skill and artistry of the musicians from Howie Smith, Director of Jazz studies at the Sydney Conservatorium, really say it all.

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## RECORDS & TAPES - continued

Apart from Don Burrows on electric clarinet, clarinet, concert flute, alto flute and bamboo flute, the others in the group are George Golla on seven-string Maton guitar; Paul Baker, vocals and electric bass; Bill Hucker, electric piano; and Alan Turnbull on drums.

The 10 tracks give the listener an insight into Australian Jazz at it's best! ABC Colour Theme - Spring - Mood Indigo - Takeda - Thanks A Million - Swampy - Georgia - Yucatan Man - Summer Rain - Minha Saudade.

The original recording was made by the ABC at the Sydney Opera House at a concert given by the Quintet and captures a lot of the ambience of a live performance. (N.J.M.)

☆ ☆ ☆

**STEPH'N'US. Stephane Grapelli, Don Burrows, George Golla. Stereo, Cherry Pie CPF-1032. (Cherry Pie Records, PO Box 225, Pennant Hills, NSW 2120. (02) 819 6151.)**

Don Burrows remembers when, as a lad, he used to listen to radio broadcasts of Stephane Grapelli and Django Reinhardt, featuring with the Quintet of the Hot Club of France. Now the well known duo of Burrows and Golla feature with "Steph" in this Australian-made album.

It carries a generous 22-odd minutes per side with the following titles. Or, at least, these are the titles they start out with:

A Fine Romance - Don't Get Round Much Any More - I Can't Get Started - I'll Never Be The Same - Down Home Blues - I Only Have Eyes For You/Shine - Solitude/Corcovado - It's Only A Paper Moon.

Stephane Grapelli plays his usual jazz violin but, by double recording, also

does a violin duo and takes over the electric piano. Don Burrows plays bass flute, alto flute, flute, and clarinet. George Golla plays only his seven-string Maton guitar but, in so doing, takes over the bass line as well.

It's enjoyable "fun" music, exactly as you'd expect from such a gifted trio. The recording itself is excellent. (W.N.W.)

☆ ☆ ☆

**THE EASY WINNERS. Ragtime music of Scott Joplin played by Itzhak Perlman and Andre Previn. World Record Club stereo R 06402.**

For quite a few years now, music students and teachers have more or less accepted ragtime music as being in the classical idiom and have incorporated it into their repertoire. But it is only recently that concert performers have given ragtime recitals and these have been favourably received. Now we have this performance on record with Perlman on violin and Previn on piano.

And those who have only heard ragtime on piano, I am sure, will be delighted with this elegant duo performance which beautifully captures the moods and syncopation of Joplin's music. Recording quality is good.

Ten Joplin tunes are featured: The Ragtime Dance - The Easy Winners - Bethena - Magnetic Rag - The Strenuous Life - The Entertainer - Elite Syncopations - Solace - Pine Apple Rag - Sugar Cane. (LDS).

☆ ☆ ☆

**ADVENTURE. Rupert Holmes. MCA Records MCA5129. Astor release.**

Rupert Holmes became known last year when he had a No. 1 song with "Escape (The Pina Colada Song)" and a

## Impressive recording

**BONFA, BURROWS BRAZIL. Stereo, Cherry Pie CPF-1045. [Cherry Pie Records, PO Box 225, Pennant Hills, NSW 2120. Phone (02) 819 6151.]**

This Cherry Pie album features Don Burrows on flutes, sax and percussion; Luiz Bonfa, guitars and vocal; George Golla, guitars; Paul Laker, electric bass; Doug Gallagher, drums; Tony Ansell, electric piano; George Andre, electric bass; Jose Boto on drums. Add a full string chorus, as needed and you have a most impressive array of talent.

As per the title, the sound is predominantly Latin American - uninhibited, brilliantly played and suitably varied to avoid any risk of tedium.

There are 13 tracks in a generous program: Shade of the Mango Tree - Sosticado - Enchanted Sea - Batucada



- Minina Flor - Giselle - Prelude - Passeio No Rio - Morning of the Carnival - Amoroso - Indian Dance - Himalaia - The Gentle Rain.

For the recording itself, Cherry Pie have to be given the highest credit. The transients from acoustic guitars have the potential to be startling and they certainly are here. Had the pressing been endorsed "digital", I would have believed it. Recommended. (W.N.W.)



# The sound of the 30's

**PENNIES FROM HEAVEN.** Soundtrack of the BBC serial featured on ABC TV. Various bands of the 30s. EMI mono EME-1029. World Record Club release.

I jumped at the chance to review this soundtrack of the six-part BBC serial featured on ABC-TV during the early part of 1980. This controversial but most enjoyable series used original records from the 30s to which the main characters mimed, which was most amusing.

Naturally, since the tracks are transcriptions from the original recordings, the quality is genuine, squawky 78rpm standard. Clearly, the disc is likely to interest

successful follow-up single "Him".

If you enjoyed these records, his latest album should appeal to you. There are 10 tracks on the album that range from ballads to up-tempo numbers and each track has clear and concise vocals and refreshing musical arrangements.

A very well produced album. The tracks are: Adventure — The Mask — Blackjack — You'll Love Me Again — Cold — Morning Man — I Don't Need You — Special Thanks. (D.H.)

☆ ☆ ☆

**CLOSING THE GAP.** Georgie Fame. PRT Records. N137. Astor release.

Georgie Fame is well known in the reggae market and his latest album includes two classic songs that have been revived in the reggae style, namely Bread's "Everything I Own" and Stevie Wonders "Uptight".

The other seven tracks on the album are new compositions: Give A Little More — Run Away With Me — I Love Jamaica — Eros Hotel — Lean On Me — Bring Back My Love — Give A Little More (Dub version).

All in all, a very interesting album that should appeal to most popular music listeners. (D.H.)



only those who enjoyed the TV series, as I did.

There are 16 tracks, with titles such as: Hands Across The Table — The Moon Got In My Eyes — Haunting Me — Roll Along Covered Wagon — Seein' Is Believin' — Pennies From Heaven (L.D.S.)

**THE SCENT OF THE ROSES.** Mary O'Hara. Stereo, Chrysalis L-37451. Festival release.

Mary O'Hara is a gentle Irish lass, with a gentle soprano voice singing, here, gentle songs of roses, gardens, creatures, the seasons and love.

You Are The New Day — The Prayer Of The Badger — The Rainbow Connection — Child Of The Woodland — Greenfinch and Linnett Bird — The Scent of the Roses — Try To Remember — The Garden Song — Ye Banks and Braes — As I Walked Forth One Summer's Day — Chanson Pour Les Petits Enfants — I Gave My Love A Cherry.

It's just a pity that the producers did not think to include a sheet of the lyrics, the only words given being those of Thomas Moore's "The Scent Of The Roses". But I doubt that that will deter the members of the Mary O'Hara Club or my own secretary who "put in her order" for the review copy!

In some of the numbers, Mary O'Hara provides her own accompaniment with celtic harp; in others, a string orchestra provides additional support. The sound quality is quite okay. (W.N.W.)

## For classical organ lovers

**BUXTEHUDE.** Douglas Lawrence plays the Ormond College Organ. Stereo, Move MS-3026. (Move Records, Box 266, Carlton South, Vic 3053. \$8.99, record or cassette).

Anyone who has reservations about monster organs — whether acoustic or electronic — and the oceans of sound which they can produce, should welcome this album.

Built in 1973 by Australia's Ronald Sharp, the Ormond College Organ is notable, by comparison, for its modest array of stops: five and a mixture on each of the manuals, four on the pedalboard, three couplers and tremulant. But it has a clean, incisive sound, that is the exact opposite of its bloated, big-brother

romantics.

The soloist, Douglas Lawrence, is one of Australia's most accomplished organists and his program includes a selection of longer and shorter items:

Side 1: Passacaglia in D minor — Prelude and Fugue in D minor — Prelude, Fugue and Chaconne in C major — Ciacona in E minor. On side 2 are 11 choral preludes including such as "A Mighty Fortress", "God Gave us this Glorious Day", "A Child Is Born in Bethlehem", etc. Appropriate sleeve notes are provided.

The sound quality is very clean, the only thing to mar the recording at all being an occasional surface click. I commend the album to lovers of the classical organ. (W.N.W.)

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Fundamentals of Solid State has been reprinted, revised and updated showing how popular it has been. It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts very heavy going. It begins with atomic theory, diode types, unijunction, field effect and bipolar transistors, thyristor devices, device fabrication and microcircuits. A glossary of terms and an index complete the book.

Available from "Electronics Australia," 57 Regent St, Sydney. PRICE \$3.50. OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. PRICE \$4.20.



# Peter Pollard and the TRS-80 computer

In 1980 a 12-year-old boy from GyMEA, NSW, made national headlines when it was announced that he had conquered a crippling disability with the help of a microcomputer. We feel that this is a particularly appropriate story for the International Year of the Disabled.

Until he was 10 years old, young Peter Pollard was unable to read. Although normally intelligent, his brain could not assemble individual letters into words, such as spelling "dog" from the letters "d-o-g". Instead, he scrambled them up.

Peter was diagnosed as suffering from dyslexia, a disability which affects several thousand Australians of all ages. He was sent to a special school where, even after four terms of specialised tutoring, he had not progressed.

In desperation, Peter's father, a computer scientist at the Lucas Heights Atomic Energy Commission, began teaching him maths on a programmable calculator. Although Peter made some headway, he was still no closer to solving his reading difficulties.

One weekend in May 1978, Dr Pollard booked his car into a local garage for a service. "It was something I seldom do," he explains, "because I am picked up for work each morning and my wife has the car serviced if necessary through the week. While waiting for the work to be

completed, Dr Pollard wandered into a nearby shopping centre. He adds, "Again, that is something I rarely do, because I dislike shopping in the middle of a crowd." On the spur of the moment, he visited a Tandy Electronics retail store located in the centre where he spotted the TRS-80 Microcomputer System.

In those days, microcomputer systems were largely the property of computer hobbyists and sold in kit form. Even though he dealt with mainframe computers daily in his work, Dr Pollard was a "total stranger" to the new mass-produced computer. He noted that the then-current price of the TRS-80 would have left 5c change from an \$800 inheritance cheque recently received and still in his pocket. So he examined the system carefully, browsed through the owner's manual and returned to his car, considering the TRS-80 "at best, a gamble."

Over the remainder of the weekend, the Pollards agonised over whether they should "gamble" their windfall che-

que on the TRS-80. Then, at 9am the following Monday morning Dr Pollard was the first customer through the Tandy doors, with cheque in hand, and purchased a TRS-80 4K Level I.

Peter's father spent several evenings programming the TRS-80 at the Pollards' home, designing a program which allowed the 30cm video monitor to display only a small section of a particular word at a time and reading from left to right. "For example, the screen might first display CH, then CHI and finally CHIP," Dr Pollard says. "To further emphasise the correct method of reading from left to right, I programmed a picture of an elephant which followed the word along as it was formed."

The Pollard's TRS-80 "gamble" soon began paying dividends. After spending only twenty minutes per night for three weeks, Peter's reading vocabulary increased from a scant few words to nearly 3000.

But easily the greatest breakthrough came in the boy's personality. "I am amazed at the change in Peter," says his father. "From being depressed and angry, he is now a happy, confident boy."

With the aid of a Tandy Electronics' modification, upper- and lower-case characters, Peter today is reading the same literature as his first form classmates. "Tris", as Peter has christened his computer, has also been upgraded to a 16K Level II system.

Following the news of Peter's stunning success, Dr Pollard began receiving hundreds of enquiries from as far away as England. Tandy Electronics was also inundated with enquiries from around Australia.

Due to this overwhelming response, Dr Pollard presented a paper at the recent Eighth World Computer Conference in Melbourne. The paper, prepared with the help of Dr Glen Campbell (head of Basic Education at Bankstown College of Technical and Further Education), outlined the TRS-80's use in overcoming dyslexia and other reading problems.

Dr Pollard has also prepared a newsletter giving details of the teaching process. He says that the TRS-80 is ideally suited to this application, particularly because of its low cost.

He has now been invited to write a book about his son's winning battle against dyslexia and hopes to have it published later this year.

*Using a TRS-80 computer with programs written by his father, Peter Pollard has made rapid progress in overcoming dyslexia.*





## CAN YOU AFFORD NOT TO SUBSCRIBE TO MICRO-80?

MICRO-80 is a monthly magazine dedicated to users of SYSTEM 80 and TRS-80 microcomputers. Owned and produced entirely in Australia, each issue of MICRO-80 contains at least six programs, articles, useful hints and answers to readers' problems; all designed to help YOU get the most out of your SYSTEM 80 or TRS-80. Since MICRO-80's first issue in December 1979, we have published over 80 major pieces of software and 10 hardware projects. Most of the programs and articles are written by our readers to whom we pay publication fees thus enabling them to make their hobby pay. MICRO-80 readers can save money by buying Tandy products at 10% discount from an authorised dealer — for details see any issue of MICRO-80. Our sister business, MICRO-80 PRODUCTS, sells Australian designed and produced software and high quality, imported goods at low, sensible prices. We repeat, if you own a SYSTEM 80 or TRS-80,

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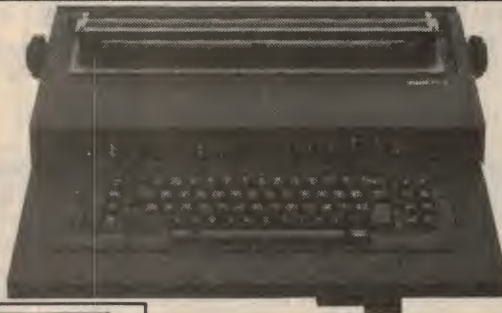
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## Daisy Wheel Typewriter/Printer

MICRO-80 has converted the new OLIVETTI ET-121 DAISY WHEEL typewriter to work with the TRS-80 and SYSTEM 80 or any other microcomputer with a Centronics parallel port (RS 232 serial interface available shortly). The ET-121 typewriter is renowned for its high quality, fast speed (17 c.p.s.), quietness and reliability. MICRO-80 is renowned for its knowledge of the TRS-80/SYSTEM 80 and its sensible pricing policy. Together, we have produced a dual-purpose machine: an attractive, modern, correcting typewriter which doubles as a correspondence quality Daisy-wheel printer when used with your micro-computer.

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TRS 80 and SYSTEM 80 OWNERS TRS 80 and SYSTEM 80 OWNERS



# Column 80

by JAMIESON ROWE

Technical Director,  
Dick Smith Electronics

## More questions & answers on floppy disks

As promised last month, here are some more answers to commonly asked questions about floppy disks and drives. So if you're still a bit puzzled about these things, read on — the answers you want may be here!

**Q: What is the "write protect" notch on a floppy disk, and what is its use?**

A: The "write protect" notch is a small slot about 8mm wide and 4mm deep, cut into the side of each floppy disk's protective sleeve. Its purpose is very similar to the notches and breakout tabs on the rear of tape cassettes — to prevent accidental erasure and recording over valuable information. The only difference is that it works in the opposite fashion.

A sensor inside the disk drive always checks the notch whenever a disk is to be written on. If the notch is open, the computer is allowed to proceed with the writing operation. However if the sensor reveals that the notch is obscured, the operation is aborted. So a piece of tape or "tab" stuck over the notch of a disk containing valuable information will protect it from being over-written.

Usually it is best to use opaque plastic or metallic tape for the write-protect tab. This is to ensure that it is effective with the sensor used in various drives. Some drives use a mechanical microswitch sensor, while others use a photo-electric sensor.

**Q: What is a disk controller?**

A: A disk controller is basically a separate, specialised computer which looks after all of the "fine details" when programs or data are either saved on a disk, or re-loaded into the main computer from a disk.

There are actually quite a lot of things which have to be done during these operations. The drive motor has to be turned on and allowed to reach its correct speed, the record/play head has to be stepped in or out to the desired track on the disk, then the head has to be "loaded" or brought into contact with the disk, and so on. Various signals are fed back from the drive to indicate its status, and these have to be analysed and acted upon as well.

The main computer could easily do all of these things, but while it was doing so, it wouldn't be able to do anything else. So it is more efficient to have a separate "dedicated" or slave computer to look after the details, while the main computer gets on with more important things. This dedicated slave computer is the "disk con-

troller". Nowadays like the main computer, the disk controller is based on an LSI microprocessor chip — in this case a specialised one.

**Q: Wherever floppy disks are used, people seem to talk a lot about the "DOS". What exactly is a DOS?**

A: Actually, "DOS" is just an acronym standing for Disk Operating System. And a disk operating system is simply a machine language program which runs on the main computer and is designed to look after all of the "housekeeping" involved in storing information on disks, and then bringing it back again.

Most DOS programs consist of a collection of routines, each of which handles a particular job. There will be routines to actually pass data and commands to and from the disk controller, for storage on or retrieval from a specified disk; routines to keep track of where particular programs or data are actually stored on a disk (what tracks and sectors, etc); routines which test for read/write errors, and work out what to do when errors occur, etc; and routines which manage overall operation and inter-relate with other programs like your BASIC interpreter, for example.

So it is the DOS as a whole which lets you save a complete program on a disk in a particular drive, simply by typing in an apparently simple command like `SAVE 0: "FEEDBILL"` (to save the program currently in memory on the disk in drive 0, and at the same time give it the name "FEEDBILL"). Similarly it is the DOS which lets you list a directory of all the files on a particular disk, or copy a file from one disk to another, and so on, all with fairly simple "high level" commands.

Needless to say, for a DOS to run properly on a particular computer system it must be set up with the necessary information as to the number of tracks and sectors per disk, whether single or double-density recording is being used, what sort of other programs are in use, where the basic system components like video screen and keyboard are located, and so on. Setting it up in this fashion for a particular computer is described as "configuring" the DOS for

that system.

A variety of DOS programs have been developed for the current breed of microcomputers. One of the most widely used is CP/M (standing for "Control Program for Microcomputers"), which was developed by a US firm called Digital Research". Another one is TRSDOS, developed by Tandy Corporation for use on their TRS-80 computers. Others are available with names like NEWDOS, MICRODOS, DBLDOS and VTOS, each offering various features and facilities. Like other programs, many have undergone a process of continuous improvement; for example TRSDOS is now being sold as "Version 2.3", while NEWDOS And MICRODOS have undergone similar revisions.

**Q: What is formatting? Why does a disk have to be formatted?**

A: When a floppy disk comes to you from the manufacturer, it is completely blank just like a fresh tape cassette. However before programs or other information can be stored on it, the various tracks and sectors must be "marked out" on it magnetically, and provided with identification numbering for later use by the disk controller.

"Formatting" is simply the operation of recording on a disk this basic track and sector information. Generally at the same time "dummy" data is recorded or "written" into each of the newly-created sectors, and then "read out" again to check that the disk's magnetic coating is satisfactory. This is all done for you by the DOS, in response to a simple "FORMAT" command.

If write/read errors are found during the formatting, one of two things may occur. If there are errors in only one or two sectors, the DOS may simply make an internal "note" to itself that the sectors concerned are flawed, and avoid using them. But if more sectors are faulty, it may tell you that the disk is unacceptable and should be discarded.

Note that a disk which has already been used can be reformatted, if desired. But when this is done any information which was left on the disk is destroyed when the new sector identification and dummy data is recorded. So before formatting a disk which has already been used, you do need to make sure that it doesn't contain any valuable data.

(Continued on page 143)



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# Microcomputer News & Products



## New Exidy Disk System From Dick Smith



Dick Smith Electronics has announced the availability of a new, self-contained add on Floppy Disk System for the Sorcerer Mark 11 computer. The new disk system provides the Sorcerer with a high capacity disk storage unit at minimum cost. All of the disk controller and interface logic is included within the unit, together with a power supply, so that the system plugs directly into the expansion socket at the rear of the computer. No. S-100 expansion unit is required.

The floppy disk system provides 77 tracks on standard soft-sectored diskettes, using the Modified Frequency Modulation, or MFM "double density" technique. Total formatted data capacity is 308K bytes per disk — sufficient for the majority of home and small business applications. For those who need more than a single drive, the controller within the unit is capable of handling up to two additional drives.

The Disk system comes complete with

a master diskette containing CP/M, the industry standard disk operating system. The version of CP/M, supplied has been specially configured by Exidy Inc to suit the Sorcerer and disk combination.

With CP/M, there is a variety of utility programs, including a Z80 assembler, a linking loader, a debug program and an editor. Also provided is a comprehensive manual covering hardware installation, software functions, and operating instructions.

Price of the Sorcerer Floppy Disk system is \$1190, and it is available from Dick Smith Electronics branches and resellers in each state.

Also available from Dick Smith Electronics is new disk driver enhancement for the Sorcerer's ROM-based word processor package. Called PPRINT/DSKCITOH, the enhancement provides the Sorcerer word processor with new features, including the ability to save and load word processor files on disk and to perform boldface and pro-

portional printing in conjunction with a suitable printer.

PPRINT/DSKCITOH is supplied on a minifloppy disk together with comprehensive documentation. Price is \$99 including tax, and the program runs under the Exidy CP/M disk operating system on a 32K Sorcerer system with two Micropolis quad-density disk drives and a suitable printer. It is available from Dick Smith Electronics branches and resellers in all states.

## 32-bit microprocessor

Intel Corporation recently announced the production of prototype versions of the 432, a 32-bit microprocessor. Made up of three very scale integrated circuits, the 432 offers the smaller size and lower cost of a microprocessor combined with many of the features of a mainframe computer. In fact Intel are calling the new chip set a "micromainframe".

The 32-bit microprocessor can address up to four thousand million bytes of memory, and support a virtual memory space of a trillion bytes (a million megabytes).

There are almost quarter of a million components in the three-chip system, more than six times the number of devices used in Intel's 8086 16-bit processor.

With programming becoming the major development cost in any new system, Intel have designed the 432 to minimise software problems. The microprocessor is designed to execute Ada, a new highly efficient programming language derived from Pascal, and developed on behalf of the US Department of Defence to be a "universal" real-time programming language. In addition, the 432 hardware operates directly on "objects" which may be tables of numbers or alphanumeric strings. Complex programming operations can be replaced by instructions which manipulate "objects" as single data types.

The first version of the 432, a development board which can be used in conjunction with Intel's Inteltec system, will be available later this year.

**Micronews  
Continued ►**



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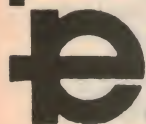
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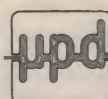
You can now also use our MicroCon general purpose microcomputer as a slave to the CBM. This allows you to connect A/D, D/A converters, digital inputs and digital outputs for industrial control, monitoring and data acquisition. Programs for the MicroCon can be created in the CBM and loaded down the IEEE 488 bus into the MicroCon for execution.

A few of the current devices now available for use with CBM and PET:

One PROM programmer for CBM user port	\$400
Barcode reader large quantity discounts	\$870
IEEE488 RS232 interface	\$320
IEEE488 Centronics interface	\$250
IEEE488 Microcon interface	\$150
Diablo daisy wheel printer	\$3000
Diablo WP printer (with interface)	\$3500

**Above prices include all cables and connectors where applicable but do not include sales tax. (Dealer enquiries invited.)**

**Write or call for prices on all the Commodore equipment.**

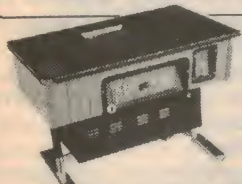


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**SPECIAL 4116 RAM OFFER**  
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## Microcomputer News & Products

### Hanimex acquires ZAP

Importer/distributor Hanimex has expanded its business and office equipment areas with acquisition of the non-component operation of Sydney-based Zilog distributor Zap Systems Pty Ltd. Hanimex will be able to offer Zilog computer products through its network of more than 50 dealers and direct representation in all capital cities.

The move follows recent Hanimex acquisition of Casio and NEC product lines in other areas of business communications and automation. The acquisition also gives Hanimex the Australian distributorship of Sanders printers, which are often coupled with Zilog's word processing systems.

Mr Brian Love, general manager of Hanimex's business equipment division, said of the move "I believe the small business computer marketing race will be won by marketing companies, not by purley computer companies".

### Low cost hard disks

The Quantum 2000 family includes 10-, 20-, and 30-megabyte Winchester disk drives in an 8-inch floppy sized package. Interface, power supply and mounting requirements are fully compatible with the Shugart SA 1000 hard disk drives and industry standard floppy drives. An optional intelligent controller board is also available.

Quantum drives are distributed by Mostyn Enterprises, PO Box 134, Rydalmere, NSW, 2116.

Telecom approval for Tekronix Data Communications Tester.

Tektronix Australia recently announced that it has gained Telecom approval for the use of its new 834 Data Communica-

tions Tester on Telecom lines. Announcing the decision, Tektronix Regional sales Manager Mr Ron Milton said "We are delighted at this new development. The 834 has already proved itself as an extremely popular troubleshooter in data communications networks since its introduction last year. Being able to connect it directly to Telecom lines will further enhance its usefulness".

Tektronix Australia are at 80 Waterloo Rd, North Ryde, NSW, 2113.

### Amtron Tyree has 'BYTEWIDE' Memory



Mostek Corporation is currently producing a series of static RAMs designed to be completely compatible with popular standard ROMs and EPROMs. Presently available is the MK4118 1K x 8 RAM and the MK4802 2K x 8 RAM. In addition to providing the convenience of a byte-organised memory on a single chip, the new parts are pin-compatible with the 2758, 2716, 2732 and 2764 EPROMs.

With the use of the Mostek chips memory boards can now be designed to accept any mixture of RAM and/or EPROM. By using EPROM devices for address decoding and a couple of wire links a "universal" memory board can be created on which both page boundaries and memory type can be varied at will. One board design can thus be used in a wide variety of applications.

Also available from Amtron Tyree Pty Ltd is a flat cable version of the Ampenol 57-series ribbon connector. The connector is currently available in 36-and

50-way versions, with 14 and 24-way coming soon. Features include spring retaining latches (20,000 Insertions or withdrawals) and simple termination to 0.050in flat cable. The 57F-series of connectors is completely interchangeable with 57-series solder or insulation-displacement type connectors, and the 50-way version is compatible with the IEEE 488 bus.

For further information contact Amtron Tyree Pty Ltd, 176 Botany Rd, Waterloo, NSW, 2017.

### Big market for process control equipment

The increasing speed and complexity of modern manufacturing processes requires the use of sophisticated control equipment to monitor, adjust and record wide range of date. When combined with advances in computer technology and the growing need for quality control, this will give a major boost to the computerisation of manufacturing operations, says Predicasts Inc, a US-based business information group.

"Process Control Equipment", a study of the US market recently released by Predicasts Research Group, sees large industrial plants controlled by a hierarchy of large central computers and dedicated micro and minicomputer devices. Measurement and display devices will continue to dominate the market, but programmable controllers will be the single fastest-growing product, increasing at over 22% a year, the report states.

Unlike traditional computers, process controllers must operate in factory environments and be able to stand extremes of temperature and vibration. Ease of programming, and falling prices made possible by volume production will also be major considerations in the acceptance of automatic control equipment. Predicasts see shipments of

**Micronews Continued ▶**

### FOR THE GOURMET



#### COMMODORE COMPUTERS

The range starts with the PET (illustrated) at under \$1,000 for personal use, through to complete business systems. We have a wide range of software covering Business, Education, Application and Entertainment.

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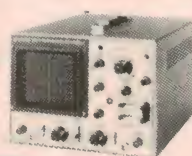
#### TRIO TEST INSTRUMENTS

CS-1560All \$650 including

probes and tax.

Other lines include:

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MOTOROLA Tweeters  
MOTOROLA KSN 1001A  
KSN 1025A



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Prices include delivery

### THIS MONTH'S SPECIAL

#### TRIO CS-2100 OSCILLOSCOPE



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100MHz bandwidth — 1mV/div sensitivity  
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## HARDWARE

KIT	DESCRIPTION	PRICE
	S/O9 6809 Computer w/128K Memory	\$3450.00
	/O9 6809 Computer w/56K Memory	\$1760.00
	6540 Printer 132 characters	\$2350.00
	S/OO S/O9 W/O Process/Mem card	\$730.00
	DT-80 12" Terminal w/monitor	\$985.00
	8209 Terminal w/monitor	\$1050.00
	8212 12" Terminal w/monitor	\$1175.80
	DT-5 2 double track double density 1-9 MB	\$1950.00
	DMF2 Disk System w/2.5m Capacity	\$2750.00
	D5-2 double side/double density 720KB	\$1395.00
	CDS-1 Winchester Hard Disk System	\$4835.00
	MP-O9A 6809 Process/Board (Assem)	\$225.00
	D5-2 double side/double density 720KB	\$1395.00
	3809 128K Memory Expansion for S/O9	\$2305.00
	MP-LA Parallel Interface	\$65.00
	MP-L2 Dual Parallel Interface	\$135.00
	MP-N Calculator Interface	\$99.50
	MP-QP Circuit Board for SP-3 (assembled)	\$78.00
	MP-R Eprom Programmer	\$119.50
	MP-S Serial Interface	\$65.50
	MP-SA Serial Interface (Assembled)	\$78.00
	MP-S2 Dual Serial Interface	\$135.00
	MP-SX Serial Interface Expansion	\$27.50
	MP-T Interrupt Timer	\$99.50
	S-32 Universal Static Memory Card	\$125.00
	MB 6809 Mother Board	\$148.50

## SOFTWARE

ASMO9 Optimizing Assembler (5" or 8")	\$110.00
Flex O9 ver. 2.6:5 w/manual	\$38.50
Inventory Program	\$110.00
Mail List Program	\$110.00
Word processing Editor & Text processor	\$165.00
Word Processing Editor	\$110.00
Text processor	\$82.50
SP-O9-2 Text Editing System	\$55.00
SP-O9-3 Mnemonic Assembler	\$55.00
SP-O9-4 Basic	\$82.50
SP-O9-5 Debug Package	\$82.50
SP-O9-6 Extended Basic	\$110.00
SP-O9-7 Standard Precompiler	\$55.00
SP-O9-8 Extended Precompiler	\$55.00
UniFLEX Multi-tasking BASIC	\$150.00
SP-O9-10 Sort/merge	\$82.50
SP-O9-11	\$82.50
* UniFLEX- Prices ex Sydney	\$495.00



PRICES SUBJECT TO ALTERATION  
EXPORT PRICES UPON APPLICATION

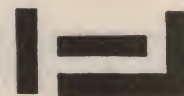
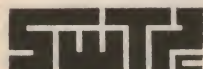
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D-5 Two double sided, double density, 5" disk drives with a total on line capacity of 720,000 bytes of data. Includes cabinet, power supply, connecting cable and controller. Controller will operate up to four drives. This is an ideal disk system for small stand alone word processing systems, or for businesses that do not work with large inventories.

14 x 6 x 10  
— 20lbs. . . . \$1395.00

D-5 or DT-5



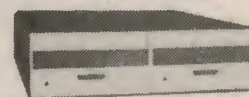
DT-5 Double track density version of the D-5. The DT-5 uses two 96 track per inch drives to provide an on line capacity of 1,400,000 bytes. Includes cabinet, power supply, connecting cable and controller. Controller will operate up to four drives. This is a disk system with enough capacity to include small inventories of up to 1,000 items, plus the usual business package of general ledger payroll, etc.

14 x 6 x 10  
— 20lbs. . . . \$1950.00

DMF-2 Double sided, double density, dual eight-inch disk system with an on line capacity of 2,400,000 bytes. Our "top of the line" disk system features a DMA type controller for fastest possible data transfers. This drive was designed for larger businesses and multi user installations. The DMF-2 will provide the fast operation necessary for systems running multiterminals under the UniFLEX operating system. Complete with

a heavy duty 1/8-inch metal cabinet, power supply, connecting cable and controller. The controller will operate up to four drives.

17 1/2 x 5 x 21 1/2  
— 53lbs. . . . \$2750.00

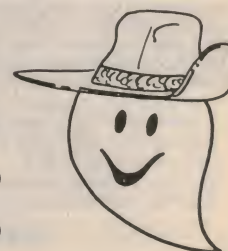


DMF2

**SWTPC BUSINESS SOFTWARE: ACCOUNTS RECEIVABLE, GENERAL LEDGER, INVENTORY, PAYROLL, MAIL LIST AND MANY OTHERS.**

## GIMIX inc. HARDWARE

32K Static Ram Board	\$580.00
16K Static Ram Board	
Expandable to 32K	\$368.00
6809 Plus CPU Card	\$532.00
5/8 Single Density Controller Board	\$249.00
5" Double Density Controller Board	\$383.00





## Microcomputer News & Products

US-made process control equipment climbing from \$4.3 billion in 1979 to \$26 billion in 1975, with major markets in Japan, Canada and the Middle East.

"Process Control Equipment", an 83-page report, is available from Predicasts Inc 11001 Cedar Ave, Cleveland, Ohio, 44106, USA.

### ZX-80 Invaders

Melbourne House Publishers recently sent us a copy of "Super ZX80 Invasion", a Space Invaders game for the 1K version of the Sinclair ZX80 Invasion, is a moving graphics game, with three levels of play, "from easy to dangerously difficult". At the conclusion of one game the program will automatically reset and challenge you again.

The program is written in Z80 machine code, which allows continuous, flicker-free action on the screen.

As a bonus the cassette also has a more sophisticated 2K version of Invaders on the other side, with more aliens, more laser bases, and 50 speeds to choose from. Each program is recorded twice on the cassette and full instructions for setting up the cassette recorder and loading the program are included in the package.

Super ZX80 Invasion costs \$19.50 and our copy came from Melbourne House, Suite 4, 75 Palmerston Cres. South Melbourne, Vic, 3205.

## Vector Graphic Business System



Vector Graphic Inc has introduced a business computer system with Winchester hard disk storage. The new Vector 3005 system includes a 14cm 5-megabyte Winchester disk, a 630 kilobyte double-sided, quad density floppy disk, a Vector-3 computer, display terminal and keyboard, and with a range of Vector software.

Both the Winchester and the floppy disk are controlled by a board which includes error-correction capabilities. The board automatically corrects up to five erroneous bits of data in every 256 bits, eliminating errors due to disk contamination or aging. Both disks have a track-to-track access time of 3ms, and are hous-

ed in a compact cabinet which sits beside the 3005's display terminal.

All Vector Graphic software, including the recently-announced Memorite 111 advanced word processing package and Execu Plan financial planning system operate on the Vector 3005. Software provided includes the CP/M operating system, SCOPE editor, a debugger and assembler, and Microsoft basic 80.

The Vector 3005 is well suited to use in accounting, insurance, financial consulting and other small business which need the storage capacity provided by the hard disk. The sealed disk unit also allows the system to be used in a factory or other harsh environment without risking loss of data.

More information on the Vector 3005 system is available from Vector's Australian distributor, Dicker Data Projects Pty Ltd, 31 Cawarra Rd, Caringbah, NSW, 2229.

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AT COMPUTER COUNTRY — We have always believed our customers are entitled to quick delivery and total and comprehensive after-sales service and advice. We have based our whole business on providing quick and efficient delivery and professional after-sales support. So if you are thinking of purchasing a microcomputer system or adding to the one you already have, make a good investment — invest in a little bit of time to talk to the professionals at Computer Country. Remember the quality of the after-sales hardware service and continual after-sales software and hardware advice you get is just as important as the price of the system you buy. Come and have a chat with the professionals of Computer Country just once and you'll realise how much help we can be in enabling you to get the most out of your microcomputer system.

Computer Country stocks a wide range of microcomputer hardware including the Apple, Northstar, Commodore, Texas Instruments, NEC, Impact data and many more. We carry a wide range of software for many systems including the TRS-80. We can also help you in customising software for your specific application.

Our service department not only completely backs up all hardware purchased from us, but invites enquiries from those who have purchased elsewhere and have hard-to-fix problems.

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### Multilingual Computers

Zeda Computers International Ltd recently announced a programmable character set for the Zeda 580 and 520 microcomputer series which allows the use of foreign languages or customised graphics characters. The Zeda 120 Programmable Character Generators allow all 128 video characters in the Zeda 580 and 520 computers to be modified to adapt to multilingual or detailed graphics applications.

Characters are loaded into a programmable character RAM through the aux-

**Micronews  
Continued ►**





# In the world of personal computers there is just one that is known as the best: the PET

**NOW  
16K RAM  
AT 8K PRICE  
\$999**

The Commodore PET has become the standard for the Personal Computer Industry.

The Pet is completely integrated, with the processor, memory, keyboard and visual display unit contained within a robust housing, allowing easy transportation with no interconnecting cables necessary. In order to retrieve and save your data and programs, a storage device is used which operates like a cassette recorder, with your information recorded reliably on standard cassettes. The PET has 16k bytes of RAM. Optional equipment permits expansion to 32k. Also, it has 14k bytes of ROM.

The Pet communicates in BASIC—the easiest computer language. Easy to learn and easy to use, BASIC has now become the standard for personal computers, with literally thousands of programmes available. The PET is also programmable in machine language, allowing more efficient use of the system.

The full-size keyboard is capable of producing letters, numbers and graphic symbols. Upper and lower case is standard. Characters appear

on the screen in a pleasant green colour designed to reduce eye fatigue and may be displayed in normal or reverse print.

PET's IEEE-488 Bus—just like H.P.'s mini and full size computers—permits direct connection to over 200 pieces of compatible equipment such as counters, timers, spectrum analysers, digital voltmeters and printer plotters from H.P., Philips, Fluke, Tectronix and others.

The full range of Commodore Disk Drives and Printers are plug-compatible with the PET and a comprehensive range of cassette and disk based programmes are available through the extensive network of Commodore Dealers.

## APPLICATIONS

The Commodore PET is a creature of many faces. Its applications are limited only by the user's imagination.

The future of the PET is virtually unlimited; its present capabilities are already many and impressive. As a personal computer, the PET can teach languages and mathematics; play games; create graphic designs; store meal recipes and change

number of portions; maintain budgets, personal records and checkbooks; operate appliances and temperature controls.

As a management tool, it delivers the information the executive needs, in the form he can use, and available to him alone. Trend analyses charts and graphs can be almost instantly available.

The professional may use the PET for maintaining appointment schedules, recording income and expenditures and filing all the specialized information and forms he may need to make his work more efficient—from medical records for a doctor to income tax computations for an accountant.

The engineer, mathematician, physicist, has a tool far superior to the very best programmable calculators yet developed... at a cost that is comparable... and with almost infinitely greater versatility.

And the businessman has a computer that can maintain inventories, keep payroll records, operate accounts payable and receivables, issue cheques and handle correspondence.

## Commodore PET 4016 Computer Technical Specifications.

### Computer/Memory

- Read/Write Memory (RAM) 16K bytes available to the user.
- Read Only Memory (ROM) 14K bytes in total, divided into:
  - 8K BASIC interpreter available immediately you turn on your PET.
  - 5K Operating System
  - 1K Test Routine
- The 6502 micro-processor chip makes the PET one of the fastest and most flexible BASIC systems. Significant features of Commodore BASIC are:
  - 960 simple variables
  - 960 integers
  - 960 string variables
  - 960 multi-dimensional array fields for the above 3 types of variables
  - Up to 80 characters per program line with several statements per line
  - Upper/Lower case characters and graphics capability
  - Built in clock
  - 9-digit floating point binary arithmetic
  - True random number generator
  - Supports multiple languages; machine language accessibility

### Keyboard

- 74-Key professional keyboard.
- Separate calculator/numeric pad.

Upper-case alphabetical characters with shift key to give 64 graphics characters. Can be set for lower case and shifted upper case characters.

### Screen

- 40 characters wide by 25 lines (1000 characters in 8 X 8 dot matrix).
- 23 cm screen phosphor screen.
- Brightness control.
- 64 ASCII plus 64 graphics characters.
- Blinking cursor with full cursor control, including programmable control.

### Screen editing capabilities

- Full cursor control (up, down, left, right).
- Character insert and delete.
- Reverse character field.
- Overstriking.
- Return key sends the entire line to the CPU regardless of cursor position.

### Input/Output

- 8 bit parallel input/output port.
- IEEE-488 Bus (HP-IB and IEC Bus) allows up to 12 other peripherals to be connected.
- Two cassette ports.
- Video signals for additional displays.
- Serial output port.

### Technical Data

- Dimensions: Height 355 mm (14"), Width 419 mm (16.5"), Depth 185 mm (7.3"). Shipping Weight 20.9 kg (46 lbs).
- Power requirements 240V  $\pm$  10%, Frequency 50 Hz, Power 100 Watts.

## Commodore BASIC

APPEND	GOSUB..RETURN	STOP	SPC
BACKUP	IF..THEN	SYS	LEFT\$
CLOSE	INPUT	VERIFY	RIGHT\$
CLR	INPUT *	WAIT	MID\$
CMD	LET		CHR\$
COLLECT	LIST	SGN	ASC
CONCAT	LOAD	INT	LEN
CONT	NEW	ABS	VAL
COPY	ON..GOSUB	SQR	STR\$
DATA	OPEN	SIN	TI
	POKE	COS	TI\$
DEF/FN	PRWT	TAN	ST
DIM	READ	ATN	DS
DIRECTORY	RECORD	LOG	DS\$
DLOAD	REM	EXP	+
DOPEN	RENAME	AND	-
DSAVE	RESTORE	OR	*
END	RUN	NOT	/
FOR/NEXT	SAVE	TAB	↑
GET	SCRATCH	POS	π

# commodore

## microcomputers

For details of your local dealer send to: Commodore Information Centre, Box 336, Artarmon, NSW 2064, Australia. Phone (02) 437 6296

M141 469



# INCREDIBLE: 32K SORCERER FOR A 16K PRICE!

## NOW Sorcerer MkII with 32K RAM at no extra cost!

Yes! With every 16K Sorcerer computer, we now include at no extra charge, an additional 16K of RAM! Here's your chance to buy the superb Sorcerer, and save money at the same time.

### Plus these other winning features:

- Unbelievable graphics capabilities.
- Expandable to 48K on board.
- Interchangeable ROMPACS™ for incredible versatility.
- Built-in 4K ROM resident monitor.
- Built-in serial and parallel ports - standard!
- 2 cassette control ports - both with motor control!
- Economic disk storage now available (optional) with Exidy's new FDS - floppy disk subsystem (does not need expansion interface).\*



### ROMPACS™ makes Sorcerer uniquely versatile

Plug-in ROMPACS™ change the Sorcerer into a dedicated processor: with instant change back again! ROMPACS™ available include Word Processor Pac, Development Pac, EPROM Pac. Ask for details at your nearest store.



## all this \$1395 for only

X-3002

and including 32K  
memory and standard  
BASIC ROMPAC™.

\*See page 140  
for this exciting system.

**DICK SMITH  
Electronics**



**SEE OUR OTHER ADS FOR  
FULL ADDRESS DETAILS**



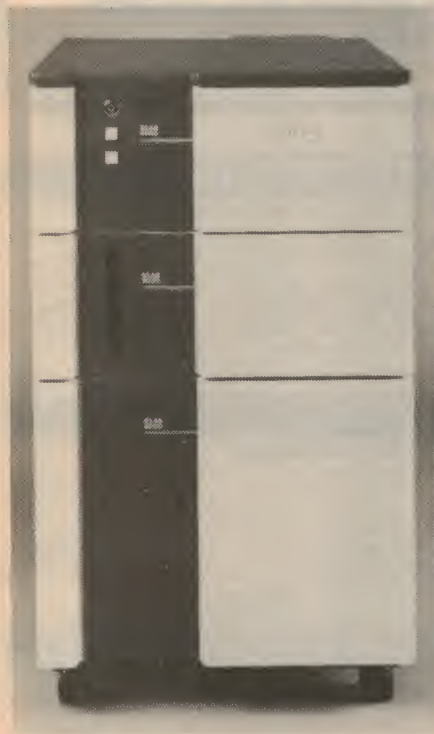
## Microcomputer News & Products

iliary parallel port of the Zeda 580 or the Centronics printer port of the 520 series. The Zeda 120 is installed inside the cabinet of the computer, and all necessary cables and connectors are provided.

Software available includes a character editor to allow the design of customised characters and a standard English character set on diskette. In addition a software package called Lingual can be combined with the Character Generator, allowing any foreign language print wheel available for the NEC Spinwriter to be used for multilingual word processing.

For further information contact Zeda Computers International Ltd, 1662 West 820 North Provo, Utah, 84601, USA.

### Z8000 Development System uses UNIX



A Z8000-based multi-user development system designed to take full advantage of the Unix operating system has been announced by Zilog Inc. The Z-LAB 8000 Programmer's Development System is capable of supporting up to 16 users, and runs the Zeus operating system, Zilog's enhanced version of the Unix system. It can be used to develop code for all Zilog CPUs, the 8-bit Z80, the 16-bit Z8000 and the Z8 single chip microcomputer.

### Phil Gleeson joins Applied Technology

Phil Gleeson has been appointed General Manager of Applied Technology. Phil is well known to electronic enthusiasts Australia wide and has had extensive experience with Dick Smith Electronics over the past seven years.

Announcing the appointment, Owen Hill, Managing Director of Applied Technology, stated that Phil's experience would greatly benefit the organisation and the customers. Applied Technology has become a leader in the microprocessor field and with the recent growth in the industry, more outlets would be required. The expansion program and development of new product marketing will be Phil's specific responsibilities.



The Z-LAB hardware is based on the 6MHz segmented Z8001 CPU. The system supports up to 1.5 megabytes of error-correcting memory, and uses 24 megabyte 20cm Winchester disk drives. The CPU board also contains eight serial I/O ports with programmable baud rates.

According to Bill Carrico, director of components marketing, the Unix system was selected for the Z-LAB 8000 to answer the need for increased programmer productivity. "The UNIX system was designed specifically for software development and text processing. It has a large user base and a large software base of development related applications . . . Zilog added file-access controls, a system generation capability and a full screen-oriented editor. The resulting ZEUS operating system is the optimum programmer's environment."

ZAP System Pty Ltd, 51-53 Chandos St, St Leonards, NSW, 2065, are the Australian distributors for Zilog products.

### New products from Commodore

Following a visit by the directors to the USA and UK, B. S. Microcomp has acquired the Australian distributorship rights to a number of products related to Commodore microcomputers. These include DMS — a powerful Data Management System for all disk-based Commodore systems — high resolution graphics hardware and software for both 40-column and 80-column machines, and the "Programmer's Toolkit" enhancement to Commodore Basic.

Also available from B. S. Microcomp is an RS232 Test Set, designed for testing all types of RS232 interface circuits.

Bill Saunders of B.S. Microcomp took the opportunity to visit the 6th West Coast Computer Faire in San Francisco,

and reports that the major developments in the microcomputer scene over the next year will involve hard disk technology and the advent of Japanese microcomputers. Microcomputer net-working also promises to be an expanding area.

Commodore are now manufacturing their long-awaited VIC (Video Interface Computer) at their Santa Clara plant,

**Micronews  
Continued ▶**

*Software  
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We have a COMPLETE range of DISK and TAPE-based SOFTWARE and PERIPHERALS for the SORCERER including:

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— in fact everything for the SORCERER (or any CP/M Micro). And if we don't have it in stock, we know where to get it — FAST!

Phone or write for our FREE catalogue TODAY.  
PO Box 364, Edgecliff, 2027. Ph: (02) 33 4536.



# You could pay \$10,000 for a word-processor! Ours will cost you just \$4,000\* and it's a computer as well.

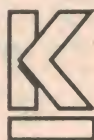
You probably already know the benefits of installing a word-processor. And you know they cost around \$10,000. They did until K&L's System 140. For around \$4,000, System 140 will outperform many units costing far more. In addition, because it is a micro-computer and not just an intelligent typewriter, it has the flexibility to do your accounts, by simply adding the right software option.

Here are some of the System 140 word-processing features:

- Standard keyboard and 640 character display. 70 pages per diskette, 80 character/sec bi directional printer.
- So simple, even the boss can use it.
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O&M/KLR003

## MICROCOMP ANNOUNCES RS232 TESTSET BREAKTHROUGH

The RS232 TESTSET is a small hand held device that connects inline with the interface cable, the terminal, or the modem and monitors the line signals. The TESTSET passes all 25 lines through and so can be left connected without affecting communications. It is completely portable as no batteries are required since power is derived from the interface signals. Each indicator circuit is current limited to meet the requirements of the RS232 INTERFACE STANDARD. Also the voltage range for activating the bright red LED display corresponds with this standard and thereby reduces troubleshooting to a "GO-NOGO" problem instead of trying to measure active signals to determine voltage levels. Seven of the most commonly used signals (pins 2, 3, 4, 5, 6, 20 or TD, RD, RTS, CTS, DSR, DCD, DTR) and an eighth "TEST" pin are connected to the LED indicators. The latter pin can be jumpered to any of the 25 lines and thereby permits any one of the remaining RS232 signals to be chosen for simultaneous monitoring. One 2-pin and one 3-pin jumper is included.

PRICE: Approx \$150.00

## BOOKS GALORE

### SYBEX Publications

Microprocessor Lexicon: .....	\$ 5.00
6502 Games: .....	\$16.00
6502 Applications Book: .....	\$16.00
Programming the 6502: .....	\$16.00
The CP/M Handbook (with MP/M): .....	\$18.00

PRINTOUT Magazine — a Commodore dedicated publication — Yearly Subscription commencing January, 1981: **\$45.00**

MANY OTHER BOOKS ARE HELD IN STOCK — THIS IS ONLY A VERY MINOR SELECTION — VISIT OR CALL FOR COMPLETE LISTS.

### OSBORNE McGRAW-HILL Publications

6800 Assembly Language Programming: .....	\$13.00
Apple II User's Guide: .....	\$19.00
PET/CBM Personal Computer Guide: .....	\$19.00
Z80 Assembly Language Programming: .....	\$19.00
Z8000 Assembly Language Programming: .....	\$24.00

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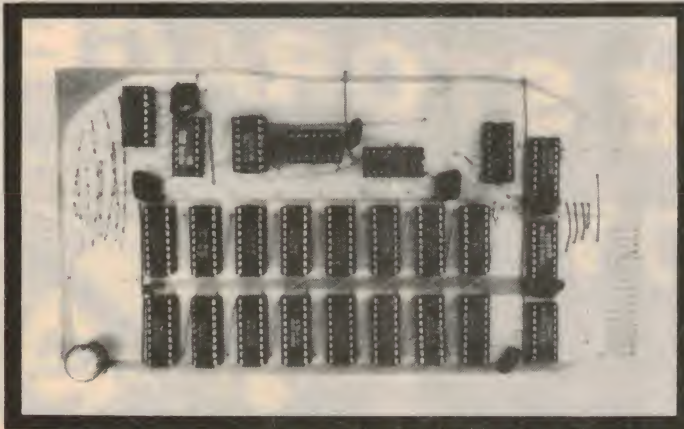


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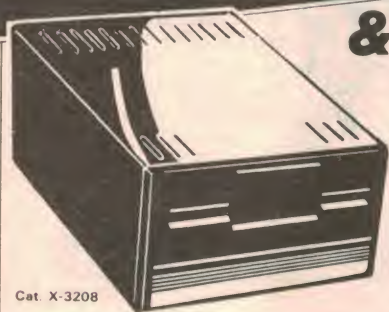
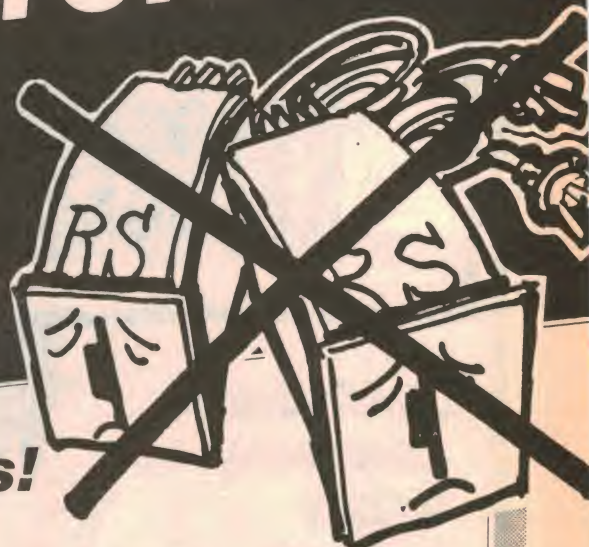
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## Microcomputer News & Products

together with a single disk drive and IBM format dual 8" disk drive. A 64K memory expansion board for the 8032 machine is also in production. All these products will be available in Australia shortly.

B. S. Microcomp are on the 4th floor, 561 Bourke St, Melbourne, 3000

## Microcomputer used in Bendix Cruise Control

Microcomputer supplied by Intel Corporation's Automotive Operations division will soon help bus and truck drivers cope with the problems of long trips. Intel's 4048 8-bit microcomputer is used as the heart of a cruise control system manufactured by Bendix Corporation of Ohio, USA. The single chip computer controls vehicle and engine speeds in relation to constant values set by the driver. Such cruise control systems reduce driver fatigue, speeding and, in most cases, fuel consumption.

The Bendix Cruise Control takes electrical inputs from transmission and engine speed sensors and regulates an air-operated cylinder which controls the throttle. The driver directs the system by two switches. One sets the desired cruising speed, which is resumed automatically after the system has been disengaged by the driver's use of the brake or clutch, and the other turns the system on and off.

The 4048 microcomputer used by the cruise controller is one of the most widely used microprocessor controllers. It consists of an 8-bit CPU, 1K of ROM 64 bytes of RAM and 27 I/O lines on a single chip. An EPROM version, the 8748, is available for program development.

## CLUB NEWS

• The latest issue of the Microcomputer Journal from the Microprocessor Special Interest Group of the Australian Computer Society (Canberra Branch) contains a 1981 membership enrolment form. Annual membership dues are \$10 for general members and \$5 for students and pensioners. Notices of MICSIG meetings will be published in the notices section of The Canberra Times on the Saturday preceding the date of the meeting.

• General meetings of the Brisbane Microcomputer Interest Group are held on the second Friday of each month, at the Old Town Hall corner of Vulture

## New VDU from Anderson Digital



Anderson Digital Equipment Pty Ltd has announced a new VDU design, manufactured by Teleray, which is said to be the smallest and lightest 30cm terminal available. The new "L"-style display unit occupies just 30cm x 32cm of desk space and weighs about nine kilos. An optional wall mounting bracket is available which allows the VDU to be tilted and swivelled for the best viewing angle while occupying no desk space at all.

The L-style terminal is initially available on two of the most popular Teleray models, the 10 and the 100. Model 10L is a page based text editor, while the Model 100L is a 132-column terminal with bi-directional peripheral port and programmable function memory.

Also available from ADE is the TVI-950 VDU, manufactured by Televideo of the United States. The Model 950 is a flexible, intelligent terminal which can be tailored to the user's requirements. The detachable keyboard provides 11 special function keys which can be programmed using 256 bytes of on-board RAM. Keys key functions and keyboard locations can be changed, and other features include editing with text wraparound, split screen displays and 15 special graphics characters.

For further information on these products contact Anderson Digital Equipment Pty Ltd, PO Box 322 Mt Waverley, Vic 3149.

and Graham Streets, South Brisbane. Doors open at 7pm and the meeting commences at 7.30pm.

• The South Australian Microprocessor Group will meet next on June 12 and July 10. The May meeting saw Jim Pope talking on the latest developments in the Commodore computer range and demonstrating the new VIC20 system.

The postal address of the group is PO Box 113 Plymton, SA, 5038.

• An Ohio Scientific Instruments microcomputer user group has recently been formed in Sydney. Details of the

**Micronews Continued ►**

## System-80 and TRS-80 Users

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Osborne/McGraw Hill (two or three disc system).

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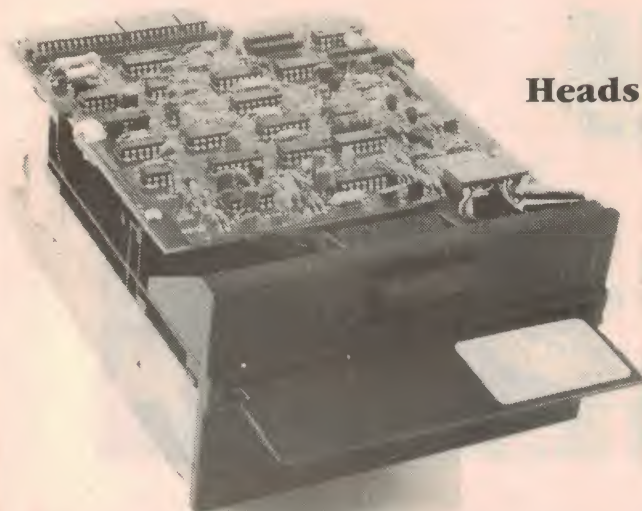
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**Tandon's TM-100 family of mini-floppies offer the absolute highest storage capabilities of any 5 1/4" high-speed, random access disk drive available in two single head and two double head models, all double density.**

**Unsurpassed Storage Capacity** - Up to an incredible 1000K bytes information on 160 tracks. Recording density is 5877 BPI.

**Advanced Dual-Head Design** - Tandon Magnetics has for years been the leading designer and supplier of read/write heads to most major disk drive manufacturers.

**Increased Throughput** - Tandon's TM-100 have a track-to-track access time of only 5 milliseconds (an incredible 3 milliseconds double track density.)

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TM100 DS -48 T.P.I.

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**FROM \$325.00**



## Cromemco

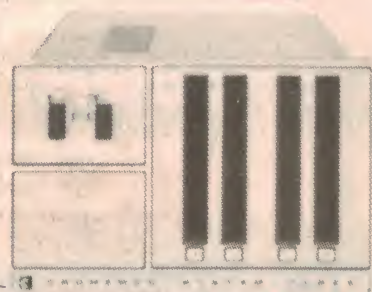
**Tomorrow's computers now**

Cromemco offers you a wide choice in high-capability computers with outstanding features such as high speed, many card slots to allow for broad system expansion, wide card support, fast memory and our much-admired Cromemco software.

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### OBSOLESCENCE INSURANCE

The nature of their construction also promises versatility and long life. Built with easily-accessible card slots, these computers can be configured to meet the needs of an almost endless variety of applications.



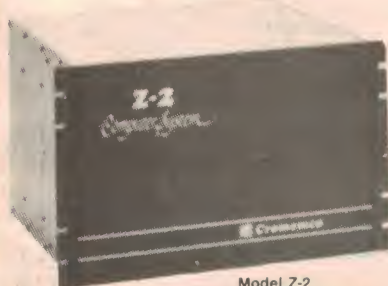
#### SYSTEM THREE

Two to four disks. Up to 512 Kilobytes of RAM/ROM Up to 4.8 Megabytes of disk.



#### Model Z-2H

11 Megabytes of hard disk storage. Up to 512 Kilobytes of RAM/ROM 780 Kilobytes of floppy disk storage.



#### Model Z-2

Up to 512 Kilobytes of RAM/ROM



#### SYSTEM ZERO WITH DDF

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NEW ★ LISP  
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NEW ★ INTELLIGENT I/O PROCESSOR  
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NEW ★ BUSINESS SOFTWARE



#### System Two

Up to 512 Kilobytes of RAM/ROM 780 Kilobytes of disk storage.

Available from —  
337 MORAY STREET, SOUTH MELBOURNE, VIC, AUSTRALIA, 3205.  
TELEPHONE (03) 690 2899. TELEX 30458. INSYST.



## Microcomputer News & Products

group's meetings and newsletter can be obtained by writing to "Noting", PO Box 250, Kingsford, NSW, 2032.

● The Computer Education Group of Victoria publishes and excellent magazine, COM-3, and maintains a resources centre and library with emphasis on the use of computers in education. Enquiries should be addressed to The Editor, COM-3, PO Box 245 Niddrie, Vic, 3042.

### CMOS Micro

National Semiconductor Corporation has begun production of its NSC800 family of low power microprocessors and support circuits. The NSC800 is manufactured with National's proprietary P<sup>2</sup>CMOS process, said to combine the speed of TTL with extremely low power requirements.

The new microprocessor executes the Z80 instruction set, and dissipates only 50mW at 5V when operating with a 2.5MHz clock. Two lower speed versions operating with .2MHz and 1MHz clocks are also available.

To complement the microprocessor National has also begun volume production of several new support chips using the P<sup>2</sup>CMOS process. Products available include standard gates, decoders and bus transceivers — all with low power requirements and high speed capability.

For more information contact National Semiconductor (Australia) Pty Ltd, 23 Cleg St, Artarmon, NSW, 2064

### COLUMN 80

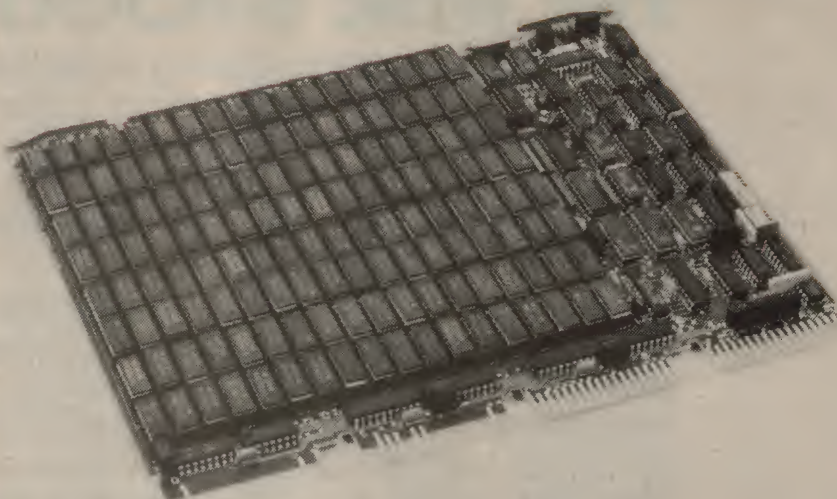
... continued from page 128

**Q: Is one disk drive sufficient for most purposes?**

**A:** No, not really. You can get by with a single drive in a few types of application, but generally speaking for serious work with most computers you really need two drives. With a lot of programs it is most efficient to have the program itself on a disk in one drive, and its data on a disk in the other. This lets you swap and change data disks when required, and make separate "backup" disks easily.

Disk copying (to make your backup copies, for example) is also much easier with two drives. You can do it with a single drive, but there is a lot of tedious disk swapping and it is easy to put the wrong disk in at some stage. So all in all, you really need two drives.

## More memory for PDP 11/44



National Semiconductor also announced the availability of two new 256K byte memory cards. The NS23Q has been designed to be mechanically and electrically compatible with LSI-11, PDP-11/03 and LSI-11/23 systems. Memory capacity of the card ranges from a minimum of 16K x 16 bits without parity to a maximum of 128K x 18 bits with parity. The starting address of the RAM can be assigned anywhere within the LSI-11/23 128K word address space.

The second new board is a 256K byte memory board for the PDP-11/70. The NS70 M card plugs directly into the MK11 MOS memory system backplane, and has a read access time of 225ns, a read cycle time of 500ns, and a read/modify/write cycle time of 650ns.

Both new boards are constructed only with specially selected, pre-tested ICs, and all RAM chips used on the board are socketed for easy maintenance.

On a larger scale, the Sydney-based Advanced Systems Division of National Semiconductor recently announced an enhanced version of its AS/9000 series mainframe, said to be the industry's largest IBM compatible general purpose computer.

The AS/9000DPC (Dual Processor Complex) will be available in the latter half of 1981. Price for a minimum 16-megabyte, 16-channel version is \$5,855,000.

For more information contact National Semiconductor (Australia) Pty Ltd, 23 Cleg St, Artarmon, NSW, 2064.

## Microcomputers? MACROSERVICE

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# THE NDK S-4000 PRINTER

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The **NDK S-4000** is supplied with a heavy duty 16 wire head producing single pass high quality 17 × 16 matrix characters at 75 characters/second for wordprocessing quality and 150-200 characters/second for drafts.

Four fonts (dot matrix, wordprocessing, super/subscript and GREEK) are supplied as standard. Typical scientific, mathematical and currency symbols are included as standard. The fonts can be intermixed as bold faced, enlarged (5 CPI, 17 × 23 matrix), reduced (12 CPI) or normal (10 CPI). Other fonts can be specified by the user. Each dot on the 16 × 16 matrix can be programmed by the host computer to produce special graphic effects (such as Letterheads and trade marks). Full page graphics is possible by controlling 10 wires of the printer and executing half-line feeds (SPELLBINDER as supplied by Software Source makes full use of the graphics capability of the S-4000). The special graphic patterns can be printed at the rate of 900 dot columns/seconds at a resolution of 4.7 dots/mm (120 dots per inch) both horizontally and vertically. A horizontal dot resolution of 240 dots per inch can be produced using half dot timing.

Superscripts and subscripts are produced by the superposition method enabling complicated mathematical formulae to be produced quickly and easily (SPELLBINDER enables the Greek character set to be used with ease). The subscripts and superscripts are half normal size and the printing pitch is half that of the PICA (see Specification).

Price \$3,509.00 excluding stand (\$176.00) and sales tax \$390.00.

## TRADE-IN SALE

We have the following traded-in systems for sale. Prices are valid until June 30th.

### VECTOR GRAPHICS MZ

The system has been fully checked out. Micropolis 5.25" drives 315k/disk 48k RAM with CP/M 2 operating system to run a serial terminal. PRICE \$3,000.

**NORTHSTAR Horizon II** 64k computer with CP/M 2 operating system 160K/floppy drive, 1 × Corvus 10 Megabyte hard disk (C and D drive) fully set-up I/O. PRICE \$7,500.

**ALTOS Computer** 48k RAM, CP/M operating system, 2 × Single density Shugart 8" disk drives (240k/disk) Serial printer port and Serial terminal port. System has just been fully overhauled. PRICE \$3,000.



# OPAL 2000C

The new OPAL 2000C computer is supplied with 64k RAM by Measurement Systems and Control with California Computer Products CPU card and Mult-mode disk controller. Additional I/O is provided to give a total of 3 × RS232c and 3 parallel ports. The disk drives are double density double sided 8 inch QUME drives with a capacity of 1.2 megabytes/drive total online capacity of 2.4 megabytes. The drives have been optimised for high speed performance. The Operating system is CP/M 2.2 with bios supplied by John F. Rose Computer Services Pty Ltd. Case and power supply are locally manufactured, the power supply is supplied with a line filter and is built to 240v Australian Standards (not 220v European standards). Full documentation is supplied with the system and the source code of the CP/M BIOS is available on request.

The OPAL 2000C will read and write to and from any combination of the following formats of 8 inch disks. The system will boot from any of the following combinations:

1. Single density single sided 8 inch disk (240k).
2. Single density double sided 8 inch disk (480k)
3. Double density single sided with up to 1024 byte sectors (600k).  
(Can also be 256, 512 etc bytes per sector).
4. Double density double sided 1024 byte sectors (1.2 megabytes).

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Send \$1.00 for your  
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## INFORMATION CENTRE

**PLAYMASTER TUNER:** I have built and to a degree successfully completed the Playmaster AM-FM Tuner. The unit performs correctly in all areas except for the clock. When power is applied the display shows "0.00" and it will begin to count normally. After a few hours, though, the clock will jump time, say from 9.02 to 14.34. It continues to do this and eventually ends up at 88.88. A slight tap on the front panel under the display will show a series of random digits. The display behaves itself when switched to the frequency mode. (C.C., Chadstone, Vic.)

● We have not heard of this problem before. Perhaps other readers have had the same experience and can suggest a cure. In the meantime, all we can suggest is that the counter chip is faulty and may have to be replaced.

**GAS DETECTOR:** I would firstly like to congratulate you on your fantastic magazine. I am 14 years old and have successfully constructed a few of your simpler projects. I would like to know whether you have presented an instrument which can sense the presence of gases, freon and other refrigerants in particular? (J.H., Daisy Hill, Qld.)

● We have published two designs for Gas Detectors. The first was in the June, 1974 issue, and the second, up-dated design appeared in May, 1977. Both designs use a semiconductor device known as a "Taguchi Gas Sensor" (TGS) after its Japanese inventor. As explained in the articles, there are two types of these sensors, one for detecting hydrocarbon gases (such as Freon), and the other for detecting smoke and carbon monoxide. Our design may be used with either type of sensor.

**VK POWERMATE:** I have heard of problems with the 723 regulator being destroyed in the VK Powermate published in May 1978, but to date mine has not suffered. A letter to the Editor of ETI commented on the value of the compensation capacitor in their November 1972 variable power supply being 100nF instead of 100pF and that this was the cause of blown 723 regulators. Your circuit is slightly different to the ETI one in this area, however the data sheets ap-

parently give a value between 100 and 500pF.

Should the value be 100pF and have you issued an errata? (R.M., South Hobart, Tas.)

● Thank you for your suggestion R.M., but the value of the compensation capacitor is correctly specified for our circuit configuration, and no errata has been issued.

**INTERFERENCE PROBLEM:** In my spare time (holidays) I adjourn to a caravan in a remote opal mining town. My power is supplied during the day through a 240V petrol-driven generator which at the same time charges a bank of 12V batteries. In the evenings to enjoy the peace and quiet I use 12V miniature fluorescent lights for lighting purposes in the van. The problem then is the use of a radio. It appears that all modern forms of transistorised radios suffer from interference from the fluorescent lights in the form of a whistle or whine which is most disturbing.

Is it possible to prevent this or should I continue to listen to the radio in the dark? (J.L., Castle Hill, NSW.)

● All fluorescent tubes radiate some interference but the problem can be more pronounced in those driven by inverters since there is no suppression capacitor across the tube as is the case when used with a starter. We suggest that you try connecting a high voltage (at least 1kV) ceramic capacitor across the tube, with a capacitance of about 500pF. On the other hand, to completely eliminate interference and yet still light your life, why not use incandescent lamps or an LP gas lamp?

**AC MILLIVOLTMETER:** The December 1980 EA project "AC Millivoltmeter" looked to be just the thing to allow me to pension off my aged valve job — made of ex-wartime disposals tubes and other junk. Also, an old metal-cased multimeter duly stripped down and cleaned up looked like the ideal mount. The meter scale printed in your article was photocopied and fitted to an old but 100% S34 "Master" milliammeter and it seemed that with a PCB from your artwork the meter would be on the air in no time.

Well it looked okay on completion and, calibrated on the upper values,

seemed to be just the "ants pants". But no, on the lower scales (3mV, 10mV, 30mV) a substantial stable meter deflection existed. It wasn't stray capacitive pick-up so what was it?

On feeding some fuel to the oscilloscope, the story was laid bare — a fairly clean 50kHz sinusoidal parasitic, reduced in amplitude as the range scale advanced, loading the input IC. So I had a Wien Bridge oscillator of sorts. But why did my circuit play up and not yours? Identical circuit and mounted as is yours.

Then the penny dropped — and therein possibly lies a message for other reader/constructors. Old meters usually have a large (metal) magnet plus magnetic circuit bolted to the rear of the meter case. This assembly is common to one side of the meter movement, and provides a fairly large capacitance with the elements of the PCB mounted immediately behind it. The input/output coupling is perfect. Zowie, a 50kHz oscillator!

The cure: I glued brass shim (about 0.07mm) around the sides and back of the S34 meter case, and soldered a lead from it to the "earthy" point — the battery centre tap position (making sure not to contact the meter terminals). A further insulating layer was then glued over the brass to avoid accidental PCB contact. For good measure I ran the input lead to the range selection switch in screened cable — probably unnecessarily. I could have used aluminium foil for the meter screen, but it presents some lead connection difficulties with lead connection. (S.M.S., Indooroopilly, Qld.)

● Thank you very much for your letter. It seems that special measures are sometimes necessary when using salvaged equipment!

**IGNITION PROBLEMS:** Just to keep the subject of TAI alive, I would like to contribute my experience with two systems, CDI and TAI. About two years ago, I built two CDI units, one for my Toyota Crown and the other for a Cortina four. After installation both units worked well and had no inherent weaknesses as described in a later edition of your magazine.

Until recently both units continued to give good service, giving slightly more power and substantially more economy in petrol consumption. Last week, a Transistor Assisted Ignition was completed and installed in the Toyota



Crown. If the former CDI unit was considered to be the "ultimate", the new unit left it for dead, with more power sweeter running and changing into top gear at lower speed for the automatic gear box. It virtually gave me a new car!

With being so enthralled with the new unit, I was sadly disillusioned with my wife ringing me to tell me the car had broken down. The RACV failed to rectify the fault or even find the cause, "with so many gadgets about". I went to the rescue and soon had the car going with a new coil and condenser (always carried) which had both broken down. The question is did 30,000km of CDI destroy the coil or was it about 80km of TAI, or a combination of both? Each time I ran the car over 7 or 8km I opened the bonnet to feel the coil or the unit (TAI) and did not find either unduly hot. (E.J.W., North Geelong, Vic.)

● We would surmise that your coil was about to fail anyway, regardless of whether CDI or TAI was in use. Nor would we attribute the failure to electronic ignition. Coils do fail occasionally, which you seem to have recognised by always carrying a spare. We would also surmise that the condenser failure was not related to the coil failure. By saying that the condenser was a "short" we assume that it was very leaky rather than a "dead short". If it was very leaky it would not prevent the electronic ignition from working and may not have been discovered if the coil had not failed.

**DIGITAL THERMOMETER:** Have you considered designing a digital thermometer for household use? Features I would require would be accuracy to within  $\pm 0.5^{\circ}\text{C}$  and a switch to enable the use of two sensor devices to be used. One of these could be indoors and the other outside or in a fishtank or refrigerator. This feature would give the thermometer a dual purpose and add to its versatility. (S.D., Bendigo, Vic.)

● Although not making any firm promises, we hope to publish a digital thermometer in the near future.

**SUPER-BASS:** I am at present using a stereo system employing 15 ohm speakers. I desire to improve the bass and reverberation, and have seen an article where a separate bass speaker is added between the two stereo speakers. I intend to use a 30cm 15 ohm unit. Could you please advise me how to include such a bass unit, and whether a crossover is necessary? (N.R., Geelong, Vic.)

● The most effective way of extending the bass response of a stereo system is to add a super-woofer, powered by a separate amplifier. What you require is our super-bass filter design, published in the February 1980 issue. The filter mixes and attenuates the signals from both

## Puzzling TV Sound Reception

**TELEVISION SOUND:** A HiFi freak's life in the country can be trying at times, particularly if one has a passion for FM and there is only one broadcaster in this area. In order to relieve my frustration I took to twiddling the dial while the TV was on and lo and behold, what strange things happened.

In this area we have a commercial Channel 8 and ABC Channel 1. When the TV is switched on and Channel 1 selected it is possible to tune the sound at about 100MHz on the tuner. It's not quite crystal clear when its good, going down to quite bad at times. The tuner is about one meter away from the TV and the two beam antennas are about three metres away from each other pointing in opposite directions. I wonder if you could provide me with an explanation?

For reasons previously described I would like to tune into TV sound especially for music programs. Could you describe how this can be done. My TV is rented, so I wouldn't like to fiddle with it. Is it possible to wire a TV tuner separately to my amplifier or path patch into my TV? If so, how? You may be able to give my system a new lease on life. (A.H., Blayney, NSW.)

channels of the existing stereo amplifier and rolls off the frequencies above the cut-off point of the filter. The output of the filter is then fed to a separate power amplifier driving the super-woofer.

**VCR PROJECT:** Firstly may I say thanks for a fine magazine. I have Volume 1, No. 1 (March 1939) and all the issues since 1954. I am a "dyed-in-the-wool" home constructor and have made many of your projects. My main interests are amateur radio and such like, and your magazine has lost some of its former charm for me as you have been rather heavily into computers lately. A good thing too, of course, but I have just not become involved with computers very much and so they are not really my thing.

However, your front cover nowadays list your main themes as being "Computers, HiFi and Video". Video — especially VCRs — is quite an area of interest for me and at the same time the old "build-it-yourself" instinct begins to move again. Have you considered the feasibility of a VCR as a construction project. I would be very interested in something like this. (O.J., Inglewood, Qld.)

● We have no plans for a video cassette recorder project. The difficulties of such a project would be immense. Quite apart from the complexities of the electronics required, there would be the matter of obtaining a cassette transport mechanism. A "do-it-yourself" VCR

● It would seem that your FM tuner and TV set are interacting to give sound reception via the tuner. The mechanism would appear to be as follows: When the TV set is tuned to the ABC channel, the set's local oscillator operating at 94MHz beats with the channel 8 sound carrier (194.75MHz) to give tuner reception of channel 8 sound at close to 100MHz. Secondly, when the TV set is tuned to channel 8, the local oscillator now at 226MHz beats with the second harmonic of the channel 1 carrier ( $2 \times 62.75\text{MHz}$ ) to give tuner reception of channel 1 sound again at close to 100MHz.

The mechanism of reception probably explains why your reception quality is so variable.

It is possible to design a TV sound tuner for connection into an audio amplifier but it virtually requires the entire "front end" of a TV receiver. Alternatively, on some TV sets it is possible to obtain an audio signal of reasonable quality, free of "frame buzz" at a point before the volume control. However, because of the safety aspect and likelihood of void guarantees, we do not recommend this approach.

would be far more expensive than one bought off the shelf.

**ACOUSTIC COUPLER:** I read with interest your article on acoustically coupling an external computer terminal to a remote computer. We are doing some experimentation with the transmission of video across telephone lines using the Robot Model 400 SSTV Scan Converter. This has an FM signal 1200Hz to 2300Hz.

What I want is a transducer that can accept the FM signal out and convert it to an audio signal so that it can be coupled into a phone handset. At the remote end I want to be able to pick up the audio signal and convert it into an FM signal to be fed back into the slow scan unit. This could then be used to relay video across phone lines for educational purposes. As such a device is not readily available perhaps you could direct me to a supplier who can help us out with a suitable device.

I realise that the signal transformation could be done with amplifiers, speakers and microphones but I'm after something more compact. (V.C., Toowoomba, Qld.)

● The FM output of the Scan Converter is already within the bandwidth of the telephones lines, and shouldn't require conversion to a different format or frequency. It may need amplification at both ends of the phone line, and acoustic coupling requires the use of a



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# PHILIPS



microphone and loudspeaker. We can think of no way to fulfill your requirements without the use of a microphone, amplifier and loudspeaker.

**TUNER/CLOCK:** I have a Playmaster AM/FM Tuner Clock and am very impressed with its performance. I would like to know how it would be possible to have the digital display in the AM mode advance in 1kHz steps rather than 10kHz steps. I have been observing some of the features that a lot of the latest commercial tuners have, pushbutton frequency advance and also frequency memories. I would like to know if these features can be incorporated into my tuner and how this can be done. — (B.D., Doncaster, Vic.)

● We know of no chip that will read out FM as well as AM in 1kHz steps. Frequency memory and pushbutton frequency advance could be incorporated in the Tuner/Clock, but would require a major redesign of the unit.

**PLAYMASTER MOSFET AMPLIFIER:** Please refer to the circuit diagram on page 43 of EA for January 1981 and in particular to the volume and tone control network, Q3 to Q5. With both pots precisely midway and with level input into the base of Q3 via 0.1μF, the response is -3dB at 40kHz, -1dB at 400Hz, -2dB at 200Hz and -3dB at 100Hz, dropping to -6dB at 15Hz. This drop in response can of course be lifted by adjusting the pot but the response is not really flat.

When the following alterations are made: connect the base of Q4 to the 15V line via a 1.2MΩ resistor, and remove the 820kΩ resistor, increase the emitter resistor of Q4 to 4.7kΩ, reduce the emitter capacitor of Q4 to 1μF and the input capacitor of Q3 to 0.047μF — the response is -3dB at 45kHz, 0dB at 1kHz, -1dB at 50Hz, -3dB at 30Hz, -6dB at 20Hz. These alterations give a flatter response and a more defined roll off at the bass end. The emitter capacitor of Q4 and the input capacitor to the base of Q3 form a 1½ section high-pass filter.

The connection of the base of Q4 to the emitter of Q5 through an 820kΩ resistor reduces the input impedance of the base of Q4 to make it sensitive to its source impedance.

The distortion mid-frequency at 100mV input is about 0.2%. If Q3 is replaced by a complementary pair this is reduced to 0.03%. This modification is not possible on the PCB but perhaps you would think about it next time. I hope that the Mosfet Amplifier will be as successful as the Playmaster 40/40. (E.A.B., Mosman Park, WA).

● While we agree that there is a slight "droop" in the bass response unless the bass control is adjusted as described in the February 1981 issue, we do not agree with these modifications. Nor do we agree that changing Q3 to a com-

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plementary pair will bring about a great reduction in distortion. Q3 is almost completely free of distortion.

**DIGITAL FREQUENCY COUNTER:** The letter from R.H.D. in the March issue prompts me to write. I experienced the same trouble with this project, only obtaining zeroes on the display, as did four or five of my friends. I think I can quickly remedy his trouble.

The problem is the level translator transistor T2. It is supplied in kits as one of two types, the 2N4258 or the PN4258, both the same except the PN4258 has its emitter and collector reversed in relation to the 2N4258. Depending on which one you get it goes in the board the opposite way round, the PN4258 with the flat edge facing left and the 2N4258 facing right, looking from the front of the PCB.

I didn't readily realise this, as the CRO still shows a square wave input to the 74LS90 with the transistor reversed. With the transistor correctly orientated the counter burst into life, and after telling my friends their counters burst into life too.

Secondly the MC10116P works fine in my counter and I can't measure any difference between the MC10116P and the MC10116L.

I hope this letter helps someone. Keep up the good work and keep projects of this quality coming. I trust you are as proud of Australia's finest electronics magazine as I am. (N.W., Enoggera, Qld.)

● Thanks for your letter N.W. and for your kind remarks regarding the magazine.

**RADAR ALARM:** I have purchased a 10GHz Radar burglar alarm in kit form. The unit uses a Philips CL8963 radar module. Following installation in my house it protects a passage-way seven metres long and 1.5 metres wide, with the unit facing towards the back of the

house, away from the road. My problem is that it is being set off by certain vehicles travelling past my house. I have been told that this could have been due to the vehicle being fitted either with electronic ignition or a radar detector.

Following tests with vehicles fitted with ignition systems like CDI and other types there is no effect at all on the unit, so I am led to believe it could be a radar detector. Is this possible?

I have also found that the infrared remote control from a colour TV will also set the alarm off. Can you advise of any precautions that I may take to counter these effects? (Z.J., Mile End, SA.)

(Continued on page 152)

## Sennheiser headphones . . .

continued from p40

parent emphasis of surface noise on records. This is inevitable when you think about it, since listening to high quality phones such as these is akin to listening in close proximity and directly on axis to a tweeter. As such, an effective remedy is judicious use of the treble control.

Midrange response is very smooth and clean while the bass response is definitely amongst the best we have heard from headphones.

Unfortunately, the Sennheiser 2002 electret headphones are far from being inexpensive. At a recommended retail price of \$349, they must be compared with high quality loudspeakers rather than other headphones. Even so, those who can afford them will undoubtedly be pleased.

For further information on Sennheiser headphones, contact the Australian distributors, R. H. Cunningham Pty Ltd, 146 Roden Street, West Melbourne, Victoria. (L.D.S.)



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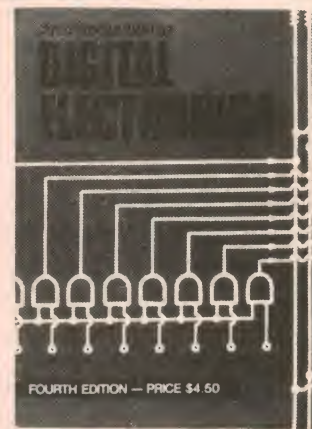
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## Letters . . . ctd from p97

the mains transformer. This is a precaution should primary to secondary breakdown occur in the mains transformer which could in turn allow the mains voltage to be injected into the chassis.

I have never seen the use of "double insulate" mains transformers mentioned in your magazine as a means of eliminating earth loops. Without question many people are forced to disconnect the mains cord earth wire from metal chassis in order to use their hifi equipment and the like. With these poor principles forced upon many people in the electronic reproduction area why not work towards the elimination of mains cord earth wire to chassis connection especially when, in my view, effective safety can be accomplished at relatively low cost.

I feel it is much safer to promote the approach described here rather than turn a blind eye to the present wide spread practice of disconnecting the earth wire in order to eliminate the annoying earth loop hum problem.

Bruce Hunt,  
Heathmont, Vic.





# Coming Next Month\*

## Moving-Coil Cartridge Preamplifier

For those who prefer the sound of moving-coil cartridges, we present this fine preamplifier using ultra well matched monolithic transistor pairs to achieve very low noise. The circuit can be battery operated or mains-powered with a plugpack.

## Peerless Loudspeakers To Build:



For those who find the loudspeaker system presented this month too large and expensive, we present two smaller Peerless systems, a 3-way 60-litre and a 2-way 25-litre job.

## Electronic Steam Whistle

A surprisingly effective circuit which can imitate the whistle of a locomotive or, with suitable adjustment, the more resonant sound of a ship's foghorn.

\* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make very attempt to include the articles mentioned here.

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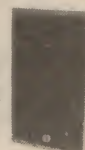
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PER KIT**

## CLASSIC RADIO

245 PARRAMATTA RD., HABERFIELD 2045

PHONES 798-7145, 798-6507



## INFORMATION . . . Cont'd

● Some radar detectors have an oscillator which produces frequencies in the microwave band, and may radiate this signal through their receiving antenna. Imperfections in the manufacture of the antenna horn and changes caused by temperature can sweep this frequency over the bands used by microwave intruder detectors, triggering intruder alarms in the vicinity of the vehicle.

Other than moving the radar alarm unit out of range of the road, you could try erecting a grounded metal sheet (or bronze flywire screens on the windows) between the alarm unit and the road, or increase the shielding of the alarm unit case itself. Microwave modules are also very sensitive to variations in supply voltage, so that transients on the supply lines can cause false triggering. As for the infrared remote control unit, it may use a modulated IR beam produced by an

oscillator which is itself radiating signals which are in the range of the Doppler shift frequencies which activate the alarm unit.

**TI-58/59 CALCULATORS:** I was extremely interested in the article entitled "The hidden charms of the Texas TI-58/59 calculators" in the November 1980 issue. I would be grateful for any information pertinent to upgrading of the memory capacity in the TI-58C. (B.B., Wellington, NZ.)

● The difference between the 58 and the 58C is the ability of the 58C to keep a program and all the memory registers alive when the calculator is switched off. It should be possible to perform the upgrade discussed in the article provided CMOS memory devices are used. We suggest that you contact your nearest TI distributor to obtain CMOS memory devices.

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Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

### N.S.W.

Applied Technology Pty Ltd,  
1a Pattison Avenue,  
Wairara, NSW 2077.

Dick Smith Electronics,  
PO Box 321,  
North Ryde, NSW 2113.

Electronic Agencies,  
115-117 Parramatta Road,  
Concord, NSW 2137.

RCS Radio Pty Ltd,  
651 Forest Road,  
Bexley, NSW 2207.

Radio Despatch Service,  
869 George Street,  
Sydney, NSW 2000.

### VIC.

Kalextronics,  
4 Burgundy Plaza,  
101 Burgundy Street,  
Heidelberg, Vic. 3084.

Rod Irving Electronics,  
425 High Street,  
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### S.A.

James Phototronics,  
522 Grange Road,  
Fulham Gardens, 5024.

### W.A.

Jemal Products,  
8/120 Briggs Street,  
Welshpool, WA 6106.

### TAS.

D & H Electronics,  
108 Campbell Street,  
Hobart, Tas. 7000.

### N.Z.

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Wellington, NZ.

Marday Services,  
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# UNTIL WE DEVELOPED THE STEREO GROOVE, HI-FI WAS PRETTY HO-HUM!



The world of hi-fi owes a lot to the original and continuing innovation of JVC. Few companies, if any, have done as much to help turn records and record-players into the virtual musical instruments they are today ... or to lead the way in developing so many *firsts* in the more recent concepts of sound amplifiers, cassette decks and computer-designed speaker

systems. Hi-fi, as we know it today, had its beginnings in 1956, with JVC's development of the 45°/45° groove for stereo records. The fact that this system still remains as the world standard is, in itself, outstanding testimony to the technology of JVC. The development revolutionised not only the record-making industry, in which we've been involved since 1930; it also paved the way for enormous advancement in the design and engineering of record-playing equipment. Now, hi-fi has expanded to



R-S77. Super-A FM/AM Stereo receiver

embrace a wealth of highly-sophisticated electronic equipment; and it's not surprising that JVC has continued to play a leading role in so much of its development.



HR-3660 EA. VHS Colour Video Cassette recorder

## THAT WASN'T OUR ONLY FIRST, EITHER.

We also pioneered Japan's television industry, introducing their first TV receiver just over 40 years ago. A more recent innovation is VHS, the home video recording system now gaining world-wide acceptance as *the* system for such equipment. In the course of staying ahead, we've introduced a number of world *firsts* of radical importance: the Quartz Lock turntable is one of them.

## THE QUARTZ LOCK TURNTABLE. MANY TIMES MORE ACCURATE.

It stands to reason that if your equipment is at the top end of the range, then your turntable must be capable of comparable performance. Only Quartz Lock ensures this, tying the speed of the turntable to the unvarying pulse of the atom, and providing a level of accuracy far in excess of conventional turntables.



## MORE MILESTONES IN HI-FI.

To match the superb quality of Quartz Lock, we produced the S.E.A. graphic equalizer system. Then we refined it to such a degree it even compensates for the effect your furniture has on sound when it leaves the speakers! To expand the capabilities of tape, we designed ANRS and



SEA-80. Stereo Graphic Equalizer

Super ANRS — automatic noise reduction systems which not only reduce distortion and 'hiss' but actually extend the dynamic range of the tape. Similarly, with speakers: at JVC we employ computers in their design to help provide the ultimate in sound reproduction.

## AND NOW, SUPER-A.

In its own way, as significant a hi-fi development as the stereo groove. Imagine an amplifier which combines the *best* features of the two recognised amplifier classes (A and B) ... an amp which combines the *efficiency* of one with the *low distortion* of the other. Some engineers said it couldn't be done; but not those at JVC. Enter the Super-A amplifier ... the *latest JVC first!*

Distributed and Serviced by ...  
**HAGEMEYER**



the right choice

## THE FUTURE.

It's already with us. For instance, we were so far ahead in the new metal tape technology that our cassette decks were metal-compatible before the tapes were generally available. And now there's the JVC Electro-Dynamic Servo Tonearm, damping tonearm resonance by means of a purely electronic system and two 'thinking' linear motors. Who was it who dubbed JVC, 'the innovators'?



# The year of the bioelectronic tonearm.

**Fully automatic and electronically controlled  
for the ultimate in high fidelity sound reproduction.**

Turntable technology is at its peak. Motors, platters and cabinets have almost all reached their performance limits. Only the tonearm remains as the last great challenge to turntable perfection. And Sony has revolutionized that with the Biotracer Tonearm.

Biotracer has dismissed tonearm resonance. Those wayward harmonics that used to break up the romance between the listener and his music. By combining a microcomputer,



velocity sensors and three linear motors in the tonearm to control every movement. All unnecessary tonearm movement caused by its own resonance or eccentricities in a record, like warping, are immediately detected by horizontal and vertical sensors. A microcomputer responds to the slightest variation and directs Biotracer's linear motors to compensate.

Sound reproduction is clear. Rich bass is richer. And high frequencies more brilliant.

All other turntable functions are also automatically orchestrated by the microcomputer. Record selection is automatic. So is repeat, lead in and out, and even stylus muting whenever it is lifted up or down.

A linear torque BSL motor, together with a quartz crystal lock and Magnedisc servo system, assures stable speed and precise platter rotation.



And Sony has paid attention to the little things. Like convenient total front panel operation including stylus force adjustment when the dust cover is down.

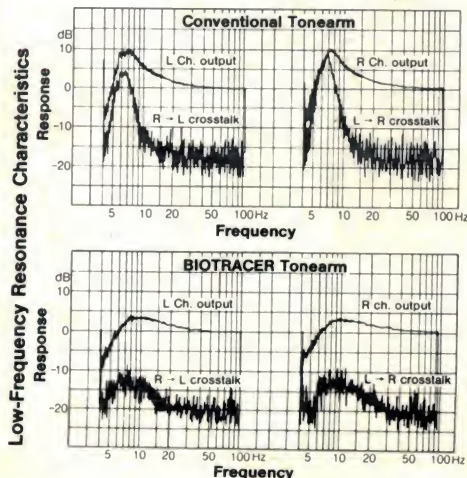
All of your music will live up to your wildest expectations. Because Sony has now perfected the entire turntable system. Even the tonearm.

The new PS-X75 turntable with Biotracer. A new year for your music.



PS-X75

The PS-X75's cabinet is made of of SBMC (Sony Bulk Molding Compound) to stifle howl. And gel filled insulators absorb acoustical energy and prevent feedback between turntable and speakers.



AP3527

**SONY®**